Promoting Learning and Teaching Visual Arts in Elementary Schools by Using Computers and Software

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Abstract:
Despite constant and numerous improvements and innovations in education systems worldwide, usage of computers and software in learning and teaching subject Visual arts on the elementary school level is not common and is therefore not widespread. Preliminary empiric research has proved that this is not only a Croatian, but an international problem. With the awareness of those facts, in short, it was decided to select and assess software that is considered as a valuable addition to learning and teaching process of subject Visual Arts. Final result of this research is a thorough analysis of carefully selected software. Performed analysis undeniably proved that such and similar software definitely has potential to greatly improve promotion of learning and teaching Visual Arts in elementary schools. Another issue that is considered in this paper is oldness of computers in Croatian elementary schools and what can be done in this regard in order to improve current condition.

1 Introduction

As an European Union (EU) candidate country, Croatia standardized and unified the methodology of learning and teaching for the subject Visual Arts in all Croatian elementary schools from 1st to 8th grade. All rules regarding the subject are acknowledged in Croatian National Educational Standard (abb. CNES, cro. Hrvatski Nacionalni Obrazovni Standard, cro. abb. HNOS) as a series of rules. Because it was introduced by the Croatian Ministry of Science, Education and Sport and signed by the minister himself, teachers in every elementary school in Croatia must promote learning, teaching, and test pupils’ knowledge accordingly.

Although, experimental implementation of CNES started in the school year 2005/2006 in only 5% of Croatian elementary schools, in the school year 2006/2007 it was implemented in 100% of elementary schools. Now in its 5th year (2010/2011) CNES remains unchanged, but empirical research shows that that revisions and improvements of standard will be more or less necessary in certain areas. This presents an excellent opportunity to emphasize importance of computers in modern primary education.

In CNES rules traditional learning and teaching methods are predominant, even though some of them are becoming slightly obsolete. Those methods should be closer to today’s pupils who, in general, belong to generations that are surrounded by and accustomed to computers and information and communication technology (ICT) at a young age and this is a fact which must not be neglected.

Despite that fact, minority of teachers in Croatian elementary schools implement modern teaching methods and activities to motivate their pupils’ learning and even smaller proportion
of them is using computers as an aid in learning and teaching. Significantly, on the basis of empirical research it was proven that this is not only a Croatian issue.

Previously listed issues helped to define problem of scientific research in this paper: Even though CNES rules encourage new and modern teaching methods, they are not used as nearly as enough as they should be. What is more, most teachers do not have the motivation, incentive(s) and vision to interconnect computers, software and various themes from the subject Visual Arts in order to create learning and teaching environment that is best suited for today’s generations.

Determined by stated problem of scientific research is closely linked - subject of scientific research in this paper: There is necessity to perform research and analysis of selected modern-day practical and theoretical problems connected with the computers (i.e. as a whole and as hardware), software (programs) and Visual arts as the elementary school subject. Because this is primarily interdisciplinary research, throughout the paper emphasis will be put on interaction of 3 previously mentioned components: computers, software and Visual arts.

Introduction of problem, subject and object of research scientific determined the paradigm for formulating the scientific hypothesis of this paper: On the basis of scientific research it is possible to investigate and scientifically identify modern-day problems in the area of interaction between computers, software and subject Visual Arts. In addition, results of scientific research will be presented in the form of original and ready-made solutions and examples of best practice in researched areas.

Even tough, it was conducted on Croatian example, the concrete results of this research were intended and to be useful for a much wider, international group of Visual arts teachers. Likewise, teachers of other subjects other than Visual Arts can successfully implement some results of this research, especially ones regarding computers and software in order to significantly improve learning and teaching in their subjects.

2 The most relevant CNES rules for subject Visual Arts that enable implementation of computers and software

CNES rules that are valid for all subjects in the elementary schools are named general rules and second, closely linked to subject Visual Arts are named specific rules. Both set of rules are included in various chapters of CNES official publication. Official CENS publication, where all rules listed in this paper are included, is called National curriculum and syllabus for the elementary school [4] and it is available in both printed and electronic version.

Review of most relevant CNES rules is essential for the overall understanding of this paper because those 2 sets of rules represent the framework for the subject Visual Arts inside which the implementation of the computers and software both for learning and for teaching Visual Arts will be recommended. The most important CNES rules are presented in 2 subparts: 1) Review of the most relevant CNES general rules, 2) Review of the most relevant CNES specific rules and 3) Summary of CNES rules and possible usages of computers and software

2.1 Review of the most relevant CNES general rules

General CNES rules are written in the 5th, 6th and 7th chapter of the official CNES publication and they present the part of framework that Visual arts share with other subjects.
First set rules are listed in the 5th chapter and the most significant ones are:

- Visual Arts is taught from 1st to 8th grade of elementary school
- Subject is taught minimally as a 1 (single) 45 minute lesson-a-week in 35 week school year

It is really not much school hours a week (in comparison to Mathematics - 4 times less), but it is still enough to implement software as the quality and valuable addition to the learning and teaching.

Among to the rules listed in the 6th chapter, the most important is:

- Visual Arts is one of the several subjects for which teachers must not organize additional work lessons with the pupils organized for the pupils with learning difficulties

In the 7th chapter the most significant general CNES rules for subject Visual Arts are listed:

- Extra lessons as 1 (single) 45 minute lesson-a-week week in course of 35 week school year
- True extra curriculum activities and therefore not obligate for all pupils
- Participation in those activities is perceived as the: individual decision of the participant, participant’s wish for greater achievement and participant’s motivation to learn in the more liberate teaching environment.
- Activities are equally suited for average pupils, gifted pupils, pupils with backwardness issue and pupils with special needs
- Two main types of activities that are especially encouraged: workshops and various projects (e.g. artistic styles, ages, fields and movements etc.).

2.2 Review of the most relevant CNES specific rules

Specific rules for the subject Visual Arts are included in the chapter with the same title, but in 4 separate subchapters. A short overview of those subchapters will be presented in this part.

Subchapter entitled Introduction the and its opening sentences are downright important. In this respect the most meaning full in context of this paper are:

- Syllabus for the subject Visual Arts in the elementary school is based upon the process of research in learning and creation
- Structure of the syllabus respects and follows the development phases of the pupils’ artistic expression and creation
- Demands from the teachers’ side are not neglected and they include the creative and flexible approach based on the knowledge of artistic issues as well as on the knowing of the artistic and psychophysical development of the pupils
- By means of artistic education the pupils obtain the permanent and useful knowledge and competences that aim at enabling them to express themselves artistically and to efficiently use the visual communication
- Visual Arts classes are therefore based on the literal observation, exploration of the immediate environment, creative study of the artwork, encouragement of the cognitive processes, research and evaluation.
- In every lesson an appropriate artwork must be shown to the pupils
- Artwork’s function is not to illustrate the motive, but it is the specific illustration of the artistic problem that pupils solve; its content, not the theme must match the artistic style.
- Connection with the other subjects should be encouraged
- Even though the thematic correlation is most often achieved by finding of the mutual motive, the more useful is the structural correlation in which subjects are connected on level of the mutual terms that should be acquired by the pupils
Goal is the title of the shortest subchapter. In it all the most important statements from the previous subchapter are summarized and formulated so that they form the achievable goal(s), both for the pupils and for the teachers, according to rules derived from Visual arts syllabus.

Subchapter Mission includes the 3 fundamental missions that determine key forms of the pupils’ artistic literacy that in the end (i.e. long run) implicate the connection between the visual perception, artistic creativity and learning. According to CNES it is expected that pupils acquire and develop the various abilities, knowledge and attitudes [4].

- **Abilities:**
  - Focused artistic observation
  - Understanding and application of the artistic techniques and tools
  - Individual and collaborative, practical and creative work
  - Visual, critical and artistic thinking
  - Artistic/visual communication
  - Establishing of the correlation links between the Visual Arts’ syllabus and the syllabus of the other subjects
  - Aesthetic judgment of art, artwork and environment

- **Knowledge:**
  - Knowledge and understanding of the artistic terms and contents from the syllabus
  - Knowledge and understanding of the artistic fields e.g. painting, sculpture, architecture, applied art, design and the new media
  - Knowledge of the cultural heritage (e.g. world, national ethno etc.)

- **Attitudes:**
  - Positive attitude towards aesthetic values of the artwork (personal and other pupils’)
  - Interest in and care for the cultural and national heritage

The last subchapter entitled Remark(s) represents summary of everything previously mentioned e.g. specific rules supplemented with several extra explanations, additional examples, further instructions and principles for the teachers. Consequently, there are no new cognitions contained in this chapter.

### 2.3 Summary of CNES rules and possible usages of computers and software

Summarized elaboration of the general and specific rules was given with the aim of presenting all of the most important issues that in a certain way affect subject Visual Arts. Throughout the Visual Arts syllabus it is possible to emphasize parts where are the best possible usages of computers and software in learning and teaching. Those 3 groups are: usages possible in the area of general rules, usages possible in the area of specific rules and usages in the areas suggested by this paper.

First area could very much benefit from the usage of computers and software extra curriculum activities. Computers and software would without doubt add depth to extra curriculum activities and would most probably appeal to much wider circle more pupils. Various pupils’ profiles that can participate in proposed extra curriculum activities united with promotion of liberate teaching environment represent excellent opportunity to add extra depth to subject Visual Arts.

Specific rules enable open huge area that can really be perceived as a vast open space for the implementation of computers and software in Visual Arts. From the introductory paragraph on pupils’ research is emphasized, it continues with the demands from the teacher,
goes further on with the demand for enabling pupils to efficiently use the visual communication and it ends with a set of various possible/proposed classroom activities. Supplementary rules greatly support everything previously mentioned by stating that at least 1 artwork must be presented per Visual Arts lesson and by evidently encouraging the connection of Visual Arts with the other subjects. Even though it would not be the most teachers’ first choice of subject to interconnect with Visual Arts, subject Informatics certainly makes all previously mentioned activities much more interesting, challenging and captivating for the pupils. This would particularly be true if computers and accompanying information and communication technologies were brought to their level by using the appropriate and carefully selected software.

Third area of usage of computers and software is not included in CNES. Among 3 listed areas this is the most practical and the most straightforward ones. These guidelines were shaped by using the empiric research method which enabled the observation, compilation and classification of specific activities. Suggested activities respect the general and the special CNES rules and, what is most important in context of this paper; represent the solutions that are instantly applicable in learning teaching and practice. On the one hand, in learning they include numerous learning methods computers and software enable and support. It is worth mentioning that term learning in CNES stands for the activity that is not essentially connected with the classroom, hence learning in the wider sense includes: usage of the learning sources that that encourage observation, pupils’ research, deduction, curiosity and knowledge on of how to learn. On the other hand, in teaching those activities include: introduction and/or conclusion of the lesson, discussion on the important issue during the lesson and repetition of the study materials. CNES also encourages learning at home and introduction of the successful learning techniques. To sum up, all of these can be seen as one more excellent chance to implement the computers and software in order to motivate modern generations to enjoy these, in their general opinion, repetitive, boring and dull and too demanding activities.

3 Software as an aid in learning and teaching Visual Arts

Software was proven to be most appropriate as a help, on the one hand, in teaching and, on the other hand, in learning certain themes in the subject Visual Arts. Thus, a variety of software was carefully selected, thoroughly analyzed and divided in 2 main groups: quizzes and flashcards.

Every day more and more teachers are enabled and educated, both trough their primary university studies and through various forms of permanent education, to use the computers, but rare are the ones who have the knowledge, courage and motivation to use specific software in their lessons. Additionally, number of computer-friendly and computer-enabled teachers in Croatia should significantly increase in the following years in order to follow and implement the guidelines presented in this paper.

In this regard, software represents the main working environment for both teachers and pupils. In spite of the fact that software is actually the primary object of research in this paper, role of computers that are the second object of research must not be neglected. Therefore, software as such will be elaborated in detail in the very next part of this paper. Main reason for this is famous rule of the thumb (that is well known by the most scientists and/or professionals in fields of business informatics and information and communication technologies detailed explanation in [1]): software is always obtained/purchased/created first and depending on minimal configuration it requires, computers are upgraded/purchased accordingly.
3.1 Browsing, assortment and categorization of software

List of essential requirements concerning software had to be made in order to select and present software that best suits needs of teachers and pupils in activities recommended for subject Visual arts.

Therefore, software that will be selected to be used in the subject Visual Arts classes had to meet the following essential requirements:

- Smooth and stable work even on the slower and older PCs
- Freeware or open source license
- Easy to install
- Straightforwardly understandable for teachers and pupils
- Compatible with the general and specific CNES rules

After requirements have been decided it was necessary browse Internet for software that will meet them. In a course of 3 months more than 60 pieces of software from various categories were downloaded, installed and thoroughly tested. More than a few disappointments arose in this period and the most significant among them were:

- Software downloaded as freeware and/or open source proved to be shareware or trial
- Certain software requires temporary or permanent Internet connection to work properly
- Some of the software was freeware in the previous version and in the current version it is trial or shareware
- Very limited functionality of freeware/open source version, so commercial version must bought if full functionality of software was to be enabled

These were the issues that are unexpected in 21st century and in the age of Internet, but evidently they ARE present and therefore they were integrated in this paper as the warning sign for all future researchers in this area. Additionally, certain types of software did not meet all listed essential requirements and others were impossible to group and fair assessment would not be possible. In the end, only 6 pieces of software met all listed requirements. The most recent versions of selected software available on the Internet were installed. While some software has pretty straightforward name that perfectly describes its type, some had to be installed in in order to sort it in correct table. As it can be seen from the table 1, first 3 pieces of software; Stu’s Quiz Boxes, Qedoc Quiz Maker&Player and Quiz were all classified as their names suggest, in the quiz software. Exception here is Qedoc Quiz software that consists of 2 completely complementary pieces of software that are actually counted as 1.

Table 1: Quiz software

<table>
<thead>
<tr>
<th>NAME</th>
<th>AUTHOR</th>
<th>VERSION</th>
<th>YEAR</th>
<th>INSTALLATION (MB)</th>
<th>INSTALLED (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stu’s Quiz Boxes</td>
<td>Stu Hasic</td>
<td>4.1.0</td>
<td>2009</td>
<td>19,20</td>
<td>27,60</td>
</tr>
<tr>
<td>Qedoc Quiz Maker*</td>
<td>Stage Intelligence Software</td>
<td>2.7.0</td>
<td>2010</td>
<td>45,00</td>
<td>30,60</td>
</tr>
<tr>
<td>Qedoc Quiz Player*</td>
<td>Stage Intelligence Software</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiz</td>
<td>Lazius Schneider</td>
<td>3.4.3</td>
<td>2006</td>
<td>5,53</td>
<td>3,68</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>98,33</td>
<td>122,04</td>
</tr>
</tbody>
</table>

* Qedoc software consists of 2 complementary pieces of software, but they are counted as 1 software

Source: Created by the authors

Furthermore, CueCard, L.A. Flash Card Creator and MemoryLifter were classified as the flashcards software. Among these only L.A. Flash Card Creator software was named straightforwardly enough to instantly distinct its type. Fortunately enough, CueCard and MemoryLifter are also flashcards software and key information on hem is in table 2.
Table 2: Flashcards software

<table>
<thead>
<tr>
<th>NAME</th>
<th>AUTHOR</th>
<th>VERSION</th>
<th>YEAR</th>
<th>INSTALLATION (MB)</th>
<th>INSTALLED (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CueCard</td>
<td>Wade Brainerd</td>
<td>1.5.1</td>
<td>2008</td>
<td>0.74</td>
<td>2.10</td>
</tr>
<tr>
<td>L.A. Flash Card Creator</td>
<td>Lexis Rex Software</td>
<td>1.2.3</td>
<td>2010</td>
<td>2.55</td>
<td>4.98</td>
</tr>
<tr>
<td>MemoryLifter</td>
<td>LearnLift USA</td>
<td>2.3.6</td>
<td>2010</td>
<td>22.20</td>
<td>23.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>25.49</strong></td>
<td><strong>30.08</strong></td>
</tr>
</tbody>
</table>

Source: Created by the authors

It may not seem so, but all the information in table 1 is entirely correct. This stands for last 2 columns: installation and installed. Heading Installation represents the size of the installation file(s) and heading Install represents the size of the installed software’s folder. Last 2 items in the table are the ones that scramble the totals. It is because last 3 pieces of software do install some additional components, but not in the default installation folder. Disk space required for installation and testing of 6 selected pieces of software is little over 150 MB (152,12 MB to be exact) and even if user’s saved files are taken in the account this is the amount that is almost insignificant even for 10-year old disk drives that had size somewhere between 10 and 20 GB [8].

Best way to successfully implement proposed software as valuable teaching aid and method in Croatian elementary schools in the next few years is to make quizzes and flashcards creatable and presentable so that they best suit modern generations. This could somewhat difficult task because, even in their standard form, flashcards and quizzes are not considered as typical and traditional learning and teaching aids and methods in Croatian elementary schools. Another unfortunate fact regarding Croatian elementary schools is that software, in general, is not widely used in subjects other than Informatics. Nevertheless, it is very important to emphasize that almost all subjects, including Visual Arts, can benefit from results of research presented in this paper.

3.2 Testing, advantages and disadvantages of selected software

Therefore, the following part of this paper will focus on testing listed quiz and flashcard software. As both of these will be primarily used for the performing of the various learning and teaching activities and tasks in lessons for subject Visual Arts according to [1] this software is classified as the application software.

Consequently, it was necessary to create example questions prepared according to general and specific CNES rules by using all of the mentioned software. Almost same examples are used in the Visual Arts classes and they are traditionally presented to pupils in paper form or via classical overhead projector.

Chosen examples are: 1) fill-in-the blank question and 2) multiple-choice question with graphical element. This way, various features of selected software can be tested and, additionally, more methodical assessment of software can be performed.

Both examples of questions presented in this paper were selected from Visual Arts style named Pointillism that is explained in detail in [2][3][5][6] and the enclosed painting is the George Seurat’s La Tour Eiffel from the year 1889 and details can be read in [7].

Example of fill-in-the blank question is:

In pointillism the painter uses the optical colour mixing. By painting the tiny dots of red colour and blue colour by optical mixing the observer can actually see the colour ________.
Example of multiple-choice question is:

Pointillism is the Visual arts style in the field of: (Cross the square on the left of the correct answer e.g. X)

☐ Painting  ☐ Sculpture  ☐ Graphic  ☐ Architecture

In this part only non-numeric result of selected software’s testing will be introduced. Every piece of software will be presented in a form of the major advantages and disadvantages. It will also be supplemented with 2 screenshots from each: 1 for fill-in-the blank question and 1 for multiple-choice question.

**Stu’s Quiz Boxes**

**Advantages:**
- Selectable length of the quiz game (number of questions)
- Real Jeopardy quiz approach
- Points system enables straightforward distinction of easy from hard questions
- Encouragement of positive competition between the pupils
- JPG images and MP3 sounds can be added to the questions

**Disadvantages:**
- No option to minimize and resize software’s window
- Online help only
- Printing of questions and answers sheet not supported (in this version)

**Screenshots 1:** Stu’s Quiz Boxes software

**Qedoc Quiz Maker&Player**

**Advantages:**
- Individual user profiles
- Multiple language support: EN, DU, FR, GE, GR, IT, KO, PO, RU, SP, IN
- Import of numerous audio and video format as well as Shockwave Flash format
- Printing of results and certificates (of accomplishment)
- 88 different task types (types of questions)
Selectable difficulty settings
Customizable appearance and SoundFX

Disadvantages:
- 2 pieces of software that should have been 1
- Time to understand how these 2 pieces of software interact

Screenshots 2:Qedoc Quiz Maker&Player software

Source: Created by authors

Quiz

Advantages:
- Individual user profiles
- Language support: English and German
- Possibility of preparing and reading explanation after question has been answered
- Prevent cheating mode (Locks extra features by using a password)
- Results table

Disadvantages:
- No support for the import of graphical files

Screenshots 3:Quiz software

Source: Created by authors

CueCard

Advantages:
- Several print modes: study sheet, single side sheet and double side sheet
- Several study modes: learn, quiz (quasi) and review
- Merging of the different files containing flashcards
- Several import formats: Graphical files, TXT, CSV
- Several export formats: TXT, CSV
- Selectable card’s font and background colour

Disadvantages:
- Correct answers are shown in initial window at all times before star of studying
- Only 1 possible answer per question
- No help file (luckily software is quite straightforward)

**Screenshots 4: CueCard software**

- Download of flashcard deck to mobile phone (via WAP)
- Selectable flashcards order of appearance: in order, reverse, random
- Sorting flashcards in the group of 20
- Test modes: Simple, Leitner System, Type in answer
- Recording of the audio in MP3 and WAV format
- Selectable font and background colour for the cards

**Disadvantages:**
- Only 1 possible answer per question

**Screenshots 5: L.A. Flash Card Creator software**

**L.A. Flash Card Creator**

**Advantages:**
- Download of flashcard deck to mobile phone (via WAP)
- Selectable flashcards order of appearance: in order, reverse, random
- Sorting flashcards in the group of 20
- Test modes: Simple, Leitner System, Type in answer
- Recording of the audio in MP3 and WAV format
- Selectable font and background colour for the cards

**Disadvantages:**
- Only 1 possible answer per question

**MemoryLifter**

**Advantages:**
- Categorization of the learning modules
- Recording of the audio in MP3 and WAV format
- Import of the various audio and video formats
- Choice of teacher (learning method) and learning modes (types of questions):
- Standard, Multiple choice, Sentences, Listening comprehension and Image recognition
- Possible usage of synonyms (if question is structured that way)
- Multiple language support: English, German, Spanish, French, Portuguese
- Integrated style editor (colour, font…)
- Complete learning statistics (coupled reset button)
Disadvantages:
- Too complicated for beginners

Screenshots 6: MemoryLifter software

Source: Created by authors

3.3 Assessment Methodology and Assessment of selected software

The most demanding task in the process of formulating the research results was formation and preparation of assessment methodology for previously thoroughly tested software. Assessment of selected software with a single and absolute mark would be very trivial and unjust. Ranking method for selected software was also considered, but it would also be too definite because ranking would cover small nuances in numerous features that quite clearly differentiate various pieces of software.

Assessment of various software features was intentionally done after thorough testing to insure objectivity and even-handedness. Moreover, in order to perform the thorough assessment it was necessary to come up with the criteria that will enable exact and precise numerical marking of selected and tested software. In this case, assessment becomes appropriate quantitative synthesis of true qualitative and multi-criteria research. In process of forming and selecting the criteria it was necessary to interconnect results of the research in 2 main areas regarding software: software’s essential requirements with synthesized advantages and disadvantages proposed after thorough software testing. Marks for quiz software are presented in table 3 and marks for flashcards software are presented in table 4. In tables, every column heading represents certain criteria: ease of installation (E), understandable (U), range of features (R), multimedia support (M) and final mark (MARK). At the same time, 1 stands for the lowest and 5 stands for the highest mark. Final mark is calculated as the average value of the marks given for the individual criteria.

Table 3: Assessment of quiz software

<table>
<thead>
<tr>
<th>NAME</th>
<th>E</th>
<th>U</th>
<th>R</th>
<th>M</th>
<th>MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stu's Quiz Boxes</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3,75</td>
</tr>
<tr>
<td>Qedoc Quiz Maker&amp;Player</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4,25</td>
</tr>
<tr>
<td>Quiz</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3,00</td>
</tr>
</tbody>
</table>

Source: Created by authors

Table 4: Assessment of flashcards software

<table>
<thead>
<tr>
<th>NAME</th>
<th>E</th>
<th>U</th>
<th>R</th>
<th>M</th>
<th>MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>CueCard</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>3,50</td>
</tr>
<tr>
<td>L.A. Flash Card Creator</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4,00</td>
</tr>
<tr>
<td>MemoryLifter</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4,50</td>
</tr>
</tbody>
</table>

Source: Created by authors
It is very significant that 2 best marked pieces of software (Qedoc Quiz Maker&Player and MemoryLifter) are in the separate categories, i.e. 1 in quizzes and 1 in flashcards. Even though they have the best final mark, they have relatively lower mark in criteria ease of installation because of the demanding and/or confusing installation and in criteria understandable because their vast number of features requires time, patience and more advanced knowledge to understand them.

By using other criteria it was possible to clearly present the qualitative predominance of this software over more basic and mediocre ones. Finally, assessment by using the proposed criteria enabled unbiased and fair ranking of the selected software.

4 Computers as an aid in learning and teaching Visual Arts

Computers are slowly but surely becoming an essential aid in modern education. Moreover, great efforts are made on various instances worldwide to provide every pupil with a computer. In the beginning it is enough that teacher has a computer on class so that she/he can introduce pupils to software and do some introductory tutorials. After a short period (few weeks to few months) numerous different possibilities can arise once the pupils start to use computers for learning various different topics in subject Visual Arts.

One of the most important facts regarding required computers to work with proposed software is that even older and/or less powerful computers could serve as a platform for recommended software. This issue is, at the same time, one of the biggest problems in education systems worldwide.

Main reason why first software and then computers are considered in this paper is because minimal (hardware) configuration is determined by software. All selected programs had to meet one very important requirement: smooth and stable work even on the slower and older PCs. It was done quite intentionally because Croatian elementary schools are, on the basis of empiric research, rather poorly equipped with computers and computer themselves are often outdated. This means that computers in some schools are more than 10 years old. Real minimal requirements should really be tested on those outdate computers in order to receive confident and reliable information. Probably, a good number of those computers could be relatively easily optimized and/or upgraded to meet requirements of proposed software (minimal configuration). However, some may definitely prove to be too old and outdated i.e. no spare parts needed for upgrade are widely available on the market. In that case school(s) should consider buying new, but not necessarily expensive computers.

In the last several years, netbooks became excellent replacement for old, conventional desktop computers (monitor, case (system unit), keyboard etc.). Small, portable, convenient, and reliable-enough for pleasant teacher’s and student’s work - netbooks became excellent choice for performing all proposed tasks in and outside classroom, at home and on vacation. In fact netbooks are lowest performance personal computers nowadays (if smart phones are not taken into account) and all of more than 60 pieces software were also tested on a netbook.

This netbook’s most significant specifications are:
- 1,6 GHz single core Pentium processor
- 1 GB of RAM
- 1364×768 pixels, 11.6 inch (29 cm) LCD display
While (minimal) configurations with these specifications can not be bought anymore in market segments of laptops and desktops, this and similar netbooks present excellent computer for proposed (any many other) activities. At a retail price of around 2900 Croatian kunas (cca 400 €) it is reasonably priced and well affordable. However, if such computers were to be obtained in huge quantities (e.g. all elementary schools in one country or all pupils in a school) the price would inevitably be considerably lower.

5 Conclusion

Croatian National Education Standard (CNES) was introduced in all Croatian elementary schools since the school year 2006/2007. Its vital part includes general rules that are same for all subjects and specific rules that are different for each subject.

More than ever before, newer generations of pupils directly and indirectly want learning and teaching process to be more attractive and ICT supported. In the first place it means implementation of software and computers in both learning and teaching. In order to recommend the efficient way to implement software and computers CNES manual had to be carefully read to see if there are potential activities presented in the general and/or specific rules that would enable and/or support the implementation.

Fortunately, the entire set of learning and teaching activities was identified that would greatly benefit, improve and become more appealing to pupils with the implementation of software. After realizing that the only proper approach is when both, learning and teaching, aspects are equally essential, search was intentionally narrowed to software that would efficiently support both. It with 6 pieces of software (out of more than 60 tested) that were afterwards classified in 2 separate groups: quizzes and flashcards.

All software had to be methodically and impartially assessed. Therefore, it was decided to test the software by using the 2 example questions of different types that were prepared according to general and specific CNES rules. Advantages and disadvantages (in a form of qualitative analysis) were formed according to which elements of the selected questions software could or could not recreate as well as from numerous other software features.

Furthermore, advantages, disadvantages and other software features were put in numerical form in the form (marks) in order to assess software according to 4 different criteria. Use of concrete numerical criteria (ease of installation, understandable, range of features, multimedia support and final mark) enabled the quantitative multi-criteria analysis and results were presented in synthesized table. Table clearly showed that more advanced and more complex software is the best choice despite mainly minor difficulties that user can experience during their installation and usage. On the contrary, software that was downright more understandable was missing some key features and real multimedia support. In this case it was unambiguously demonstrated that simplicity, in this case, equals inferiority.

Although, on the one hand origin of software quizzes is not in education, they have proved to be remarkably interactive and very valuable innovative addition to promotion of learning and teaching Visual Arts. On the other hand, even the simplest and basic flashcards software, present a significant improvement over the traditional paper made ones. Accordingly, possibilities of the most advanced software are virtually endless and what is more it is already excellently prepared for new generations.
Last part in this paper addresses the question of computers that should support the proposed software. Even tough Croatian elementary schools are not adequately equipped with computers most of those computers can probably be satisfactorily optimized and/or upgraded in order to support newer software. However, some schools would definitely need new computers. Therefore, netbooks are, due to their multiple advantages, recommended as quality solution that can support proposed and other software. In that sense, importance of collective is acquisition is emphasized as it, in general, greatly decreases price of equipment.

Finally, scientific hypothesis of this paper: “On the basis of scientific research it is possible to investigate and scientifically identify modern-day problems in the area of interaction between computers, software and subject Visual Arts. In addition, results of scientific research will be presented in the form of original and ready-made solutions and examples of best practice in researched areas.” is proven. All things considered, research in this paper definitely ascertained that if software is thoughtfully selected, thoroughly tested, carefully assessed and objectively marked then they can indeed be implemented in the learning and teaching of the subject Visual Arts. Selected software should be supported with adequate computers because final goal of all proposed activities is to regularly use them as the addition to traditional lessons. In the next few years, further research that will focus on topics regarding practical aspects and main issues discovered in this research.

References:


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