Digital Fluency and its Importance in Educating Young Students for the Knowledge Age

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Abstract: - The article approaches the subject of digital fluency and presents the experimental results obtained while testing tools that have been developed for increasing the digital fluency of young students. The main finding of the article is that it shows a correlation between the level of digital fluency of the students involved in the experiments and their ability to use standard computer applications necessary in the every-day life. The conclusions of the article can be useful for all of those who are involved into building young minds for the Knowledge Age.

Key-Words: - Digital fluency, Knowledge Age, Information Age, Scratch

1 Introduction

We live in a world where fluency in using computers and complex digital equipment is one of the premises of social success. Although noted for a long time, the importance of fluency in using computers was first rigorously analyzed in 1999 by The National Academy of Science(USA) in the well-known report "Being Fluent with Information Technology"[1]. The report introduced the term "digital fluency", showed its importance in all areas of life and stressed the need to educate the young generation in order to be digitally fluent.

The concept digital fluency is inspired from linguistics, where it is considered that a person can talk a certain language at various level of proficiency the highest of them being fluency. According to [1], it is considered that a person is fluent in a certain language when he/she can express himself/herself in a creative way. The same is true for digital fluency where a person is considered to be digitaly fluent when he/she can act creatively in a digital environment. Obviously, in this context, creativity doesn't mean necessarily artistic creativity, as it includes various types of creativity, especially the technological one.

Fluency with information technology goes beyond the conventional concept of computer literacy[1]. This is an important distinction as computer literacy means the ability to master a few basic applications such as email clients, web clients, chat clients and word processors. By contrast, digital fluency, requires that persons master the information technology well-enough in order to use it creatively and productively to work and in the everyday life and to quick recognize the software tools and the procedures that would help them reach their goals in an optimal manner.

Nowadays computers and communications not only perform basic tasks such as controlling the engine of our car or connecting our cellular phones, but the boom of the Internet has created a huge collection of digital information that can be transformed into a major competitive advantage by those who are capable to access and process the information in a timely manner. From finding the right map of a geographical area to obtaining quick information about the best offers of raw materials, many users, from all areas of life, are finding the Internet increasingly useful in their social and professional life. The line between winners and

losers seems to be more and more dictated by the capacity to use information technologies.

Although the concept of digital fluency is new it can already be found in many of the research related to eLearning and lifelong learning. As a result, during the last years new software products appeared in the scientific community or even on the market. Initiatives such as the European "Lifelong Learning Program" are currently supporting research in this field and more applications will certainly appear in the future.

These are applications that attempt to direct the creative energy of young students or children from activities such as computer gaming towards studying the principles of computer programming which, according to [1], is an excellent way of inducing digital fluency. The goal of these applications is to offer to teenagers or young students and attractive way of performing basic programming tasks without involving mathematical concepts that many students find unattractive. During the following sections of this article, we shall provide more details about the use of digitally fluency tools.

2 Problem Formulation

The purpose of our current research is to establish if there is a correlation between the level of digital fluency of young students and their capacity to use standard computer applications necessary in the everyday life. In practical terms, we shall take a digital fluency tool and a group of students who will be asked to use it, giving us the chance to quantify their level of digital fluency. After that, we will asses their capacity to use standard software instruments, other then those considered to be necessary for considering some to be "computer literate". We intend to very the hypothesis that the higher the level of digital fluency the easier it is for a person to use standard software applications.

3 Problem Solution

In order to solve this problem we have to first establish the software instruments to be used for testing. Because of availability reasons, for the standard software applications, we will be using web development tools such as Macromedia Dreamweaver and Microsoft Frontpage. The reason for this choice is the fact that the group of volunteer students were coming from a course where their were studying web development.

3.1 Choosing the digital fluency software tool

There are few such initiatives in the world-wide scientific community that generated substantial results, the most well-known among them being the "Lifelong Kindergarten" project that has been taking place as part of the MIT Media Lab by professor Mitchel Resnick. The best known product of "Lifelong Kindergarten" project is SCARTCH, which is an attractive programming environment based on an older platform named Squeak, made by Alan Kay from Hewlett Packard[2]. Creating software products dedicated to young students and children has become a tradition for MIT, started in 1970 by the well-known professor Seymour Papert, an expert in new ways of learning trough technology.

SCRATCH is a play and learn environment [3], which is excellent for attracting the attention of young students. It is based on a graphical drag-and-drop interface which allows the user to create multimedia applications and to implement the concepts of object-oriented-programming with a few mouse clicks. In SCRATCH students can combine graphical movements with sounds, costumes and funny icons easily creating interesting applications and games. Another advantage

Due to the SCRATCH project, a new worldwide network of units was created, where young people and children can use this product and share their work through a common platform[4]. This worldwide network, named "Computer Clubhouse" (http://www.computerclubhouse.org/), has units in Asia and Latin America where a big number of youngsters are already using SCRATCH intensively[5].

Due to its large impact and the extensive research behind it, we have decided to use SCRATCH as a digital literacy software tool in our current research.

3.2 Selecting the group

The experiment has been conducted on a group of students attending an optional web development course in one of Romania's largest universities.

The process of selecting the students was based on individual volunteering. We have addressed the proposal to a large number out of which 25 volunteered for the experiment. The volunteers were required to take some extra classes of SCRATCH and to prepare a project using this technology.

3.3 Defining the evaluation system

One of the issues that had be addressed in carrying out the experiment was to find a way to evaluate the level of digital fluency of a student. This was subject to intensive debate as to what constitutes a good measure of digital fluency. In the end, the team has decided to use a simple indicator based on the number of SCRATCH features that the students used in their project. According o this indicator we have the level of digital fluency(LDF) computed according to the following formula:

$LFD = MF + SF + IF + DS + OF$ (1) where:

MF= the number of Scratch motion features
SF= the number of Scratch sound features
IF= the number of Scratch interactivity features
DF= the number of Scratch data structures
OF= the number of other features

The LFD indicator allowed the team to uniformly evaluate the projects produced by the students and to asses their level of digital fluency.

3.4 Data analysis

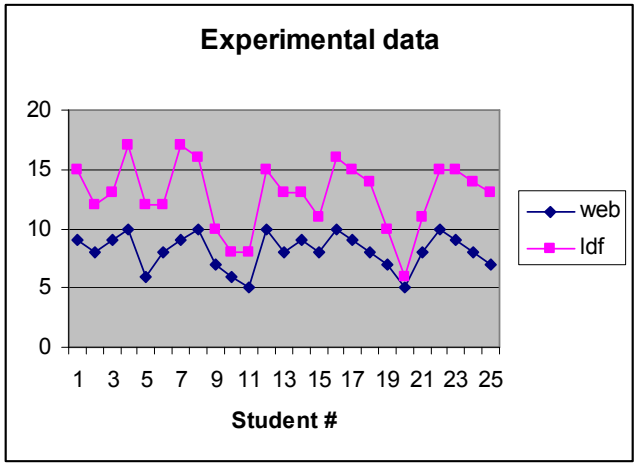
The 25 volunteers selected were first year students, age 18, attending an optional web development course. In the course their final task was to create a relatively complex website for which they received a grade from 1(minimum) to 10(maximum). The course was 14 weeks long and the project had to be presented at the end.

The volunteers agreed to take parallel lessons of SCRTACH and in the end to present a project in SCRATCH based on what they learned. The SCRATCH project, however, was evaluated according to the LDF indicator presented above.

In the end we obtained the data set presented in Table 1, which indicates the 25 grades of the students obtained for the web project and the LDF values granted for the SCRATCH one.

Student #	Web grade	LDF
1	9	15
2	8	12
3	9	13
4	10	17
5	6	12
6	8	12
7	9	17
8	10	16
9	7	10
10	6	8
11	5	8
12	10	15
13	8	13
14	9	13
15	8	11
16	10	16
17	9	15
18	8	14
19	7	10
20	5	6
21	8	11
22	10	15
23	9	15
24	8	14
25	7	13

As it can be observed from Fig. 1, where the data is represented graphically, the two data sets seem to be strongly connected.



We will verify the assumption by computing the correlation coefficient with the formula

$$Correl(X,Y) = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-\bar{y})^2}} \quad (2)$$

where x represents the web grades and y represents the LDF values.

By applying th formula (2) to the sets of data we obtain the correlation coefficient 0.886. This value indicates a strong direct correlation between the two data sets since it is very close to 1, confirming our initial hypothesis.

4 Conclusion

The analysis indicates that there is a clear connection between the level of digital fluency of one person and his/her abilities to learn how to use everyday applications. As a consequence, we can state that increasing the level of digital fluency of the young generation will increase their abilities to learn how to use computers in a world where the correct use of information technology often makes the difference between winning and loosing..

It can also be observed that special tools, such as SCRATCH, are a very good way to asses and to increase the levels of digital fluency of a person. This leads us to the conclusion that that such tools require a special attention in the educational process.

The efficiency of such tools is still to be investigated in future research related to methods to induce digital fluency. This is one of the main research aims of our teams that we intend to pursue in the future.

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