Software Contribution Tux of Math Command For Development Reasoning and Fixing Results with Simple Math

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Abstract: The purpose of this detailed work study sought to lead students to experience a differentiated alternative to work Mathematics supported on computer use. The research aimed to use the software Tux of Math Command, Linux Educacional 5.0 in mathematical activities with a group of students of the 4th grade of elementary school. We tried assess whether the application helps to speed students' thinking and collaborating for fixing the results of simple multiplication with number 5. This is a quantitative research developed in a public school located in the located in the midwest of Minas Gerais State, Brazil. The universe research was composed of 22 students. The data they were collected through observation not participant and notes in field diary. It was found that the use of the software He helped to develop students' thinking and setting the results of operations simple math. The experiment stimulated students study the multiplication table voluntarily. This analysis software is best suited to children with styles of visual and kinesthetic learning.

Keywords: Teacher training. Educacional software. Games in education

1. Introduction

Mathematics is an area of human knowledge that generates a lot of complaints, both by teachers regarding process of teaching, and by the students in relationship the learning process. You need understand the teaching and learning of mathematics in a broader context consider the contribution of other sciences, the process of training of teachers, social relations, playfulness and how children build your logical knowledge.

There are numerous studies in Education Mathematics aimed at subsidizing the teaching practice and minimize the difficulties faced by pedagogical subjects. A lot of concrete teaching materials has emerged in recent years with the same purpose as shown by theoretical studies, or assisting teachers and students to teach and learn mathematics.

In addition to these resources, other technologies may (and should) be used in the educational process, such as computer resources. Fit in that time, some reflections on the use of technologies at the process pedagogical. The teachers are able to enter them in activities in the classroom? as the technologies must be designed and planned to that this contribution actually become effective? The use technologies contributes to the improvement of learning quality of students?

Even using the technological apparatus in educational process students' difficulties related to learning mathematics can persists. The disappointment the use of a certain technology in teaching activity may contribute to the teacher reflects on adequacy of the selected technology, goals set in the planning and strategy methodology adopted.

2. Literature Review

To start the discussion on the theme of this research project, we need to address two key issues: the first It relates to how individuals learn with greater ease and dexterity a theme to them It is proposed. The second binds to the fact that important to address form such as technologies may (or may not) work with the improvement of student learning quality.

2.1. Learning styles

People don’t learn the same way. Some people learn more easily using vision, or seeing a particular event. Others learn more easily using the hearing. There are those that can learn more ease a content that can be felt tactile way that It can be experienced and exercised so dynamics.

The learning style indicates how the subject organizes, learns and stores the data. Teaching plan based on style student learning can improve quality of learning.
Recognize the ways in which the student learns. It allows the teacher to reschedule their work and curriculum, to keep the attention of views student, providing greater absorption knowledge [1].

In general, each individual has a individualized trend that get in the way how information is seized and transformed into knowledge through its cognitive structure. However, there are people who can merge more than one preference in your modus operandi to learn a determining phenomenon.

Given the peculiar characteristics of this study, let's consider learning styles cited in the text "Theory and practice of styles learning [2], entered in the classification VAK (visual, auditory and kinesthetic), proposed model Rita and Kenneth Dunn, based on different perception modalities of the world (environmental, emotional, sociological, physiological and psychological)".

Cognitive styles VAK model is classified into three dimensions: "Visual: is revealed in actions related to vision, how to observe and read; Audio: concerns actions related to hearing, as listening and speaking; Kinesthetic: involves kinesthetic (sense of touch and movement) expressing themselves in activities like feel and touch" [2].

Most people, however, is multimodal, i.e., it has strong preference for two or more styles. Some even do not have marked preference for any of them. Beyond addition, older people have a preference the most style writing and reading, while more Young people have preferences for kinesthetic style [1].

2.2. Use of software in school

Information and Communication Technologies (ICT) are media supports that extend the access to news and information based on oral and written language and synthesis of sound, image and movement [3].

ICT can expand the possibilities of communication and interaction between people, facilitating the teaching and learning process. However, it is naive to believe that they solve all educational problems and transform the school we have today in a redeeming school. The technologies are not a panacea educational issues not yet resolved.

It takes a more critical design and reflective about the role that technology can play in the educational process and, above all, they are incorporated into it.

That is, we talk about the mediation carried out by ICT for bringing people together, enabling interact and communicate with the goal, our case, to teach and learn. What I want mean by this is that there are technologies that will revolutionize teaching and, by extension, education as a whole.

But the way this technology is used to mediate between teachers, students and information. This can be revolutionary or not. Interaction processes and communication in teaching always depended most of the people involved in the process, than technologies used, whether the book, chalk or computer and networks [4].

The technologies do not teach themselves. For turn into knowledge, information accessed by the subject will depend on how interaction will occur, or is related to interest and the need of the user.

The true function of the educational apparatus not It should be to teach but to create conditions learning [5]. For the author, the change computer function comes with a critical to the function of the school and the teacher.

Unlike the students of last year, the students we have in schools today are part of a group of people who were born at the time that technological advances, especially computer (digital age), achieved great momentum and popularization. On the other hand, most current teachers grew and developed in time technology (less refined than the technology we know today) still walked to assert itself as language or mechanism learning (the pre-digital age).

The use of technology in educational activity not necessarily mean quality of teaching and learning. ICT may have deficiencies in its use, especially if it Design are placed with the critical view of the teacher.

We acknowledge bit by bit, the introduction new technical artifacts in schools does not yield in improvement effective of process teaching / learning [6].

For a computer program is inserted and really integrated into the process teaching it is necessary to analyze the software, unveil its usability and resize its role as a tool that mediates interactions between the student and information.

Plan educational activities with the support of computers requires greater time and teacher capacity building. The teacher should investigate and know well the purposes of software chosen and be aware of the proper time for its introduction. The class must be dynamic and the software used must be related with the curricular activities of the projects and stimulate problem solving [7].

Educational software is an interesting resource for education and can be effective for increase students' interest in learning Mathematics. They may also be used by teachers like A way of complement the content broadcast in room class. It is noteworthy that not all software is Educational, but they can be adapted to the context school depending on the creativity and purpose with which the teacher want to use it in your teaching activity.

The educational software are relevant in educational process and to learn mathematics, in
that it becomes more attractive for student and complementary content developed the teacher in the classroom. [8]

By examining educational software, teaching should pay attention to some aspects that go beyond the aesthetics of its interface.

When the teacher is aware of the structure of functioning of the educational program and selected the according to the goals established in its pedagogical plan, increase the chances of software reduce the difficulties of the student and improve their learning [8].

According to the study of the Johns Hopkins University (1985) 24% of time that children on the first series of the 1st. degree pass the computer is spent on games. To author, the child's point of view, the games are more fun way to learn [5].

Digital games are a field of the entertainment industry's fastest growing in recently surpassing even the industry music, and already acquired 

The fetish caused by games absorbs the attention, concentration and much of the time countless children and young people.

The brains of students has changed caused by physical good pass habit of the time watching television, playing games or surfing the internet. linear process thinking slow learning this new generation, which has hypertext minds .[1]

Shift attention to children and young people give the games and focus it on educational activities inferred efforts and does not result in a task simple. For them, educational games can be important allies of the professors in teaching because they bring in their logic Operating the dynamics, motivation and [9] activity.

It is important to look at the process learning gamers. The text appears as addition to the image being an element secondary or support. Eyes now have another importance; they should be used in addition to the simple reading of verbal [1].

The games should be used in order to developing the tangential learning, or one in which the student learns to be exposed to certain situations or contexts in which it is involved. Therefore, they should be used to learn and not to teach [1].

The games stimulate reflection and interpretation, because they have devices that allow students to resume an experience already performed (failed) to assess future possibilities of success and solution. In games, the error is handled in a way distinct as it is treated in the traditional school because allow the user to take chances and try situations and assumptions that could hardly be experienced in traditional teaching. The games allow the player to fail, can resume point of the game where failed and look alternatives to overcome the loss, that is, the error is seen as a way to learn [1].

The game differs from educational strategies Traditional (seated in lectures and reading books) because it is based on a space experience where the student is free to discover and create own learning arrangements. Exploitation a game should not be driven by a manual, but should include the possibility of user build your own path [1].

The math software can collaborate so that the work of teachers to become more attractive, fun and dynamic for students, leading them to engage in overcoming their limits and reach [8] proposed target.

Other interpretations regarding the use games as a pedagogical contract can be reading found in others and the risk that technological artifact can reverse its educational purpose.

Winning the game becomes the goal, while his pedagogical purpose is diluted in play [5].

So think and plan the use of classroom technology teacher must have in mind the skills and most striking skills of each student. Often the result frustrated an experience with ICT in educational activities arises from non-compliance and respect for learning styles of students.

2.3. Use of technology in the classroom

Several authors have been analyzing for decades, the impacts of ICT on society and the challenges they account for teacher training.

ICT enabled great advances in production process. Its insertion in the activity education requires continuing education and may require a reorganization of the teaching activity [10].

By transforming the way people related, reason and learn, ICT demand the subject restructure their interactions and networks their cognitive structure. The result of these changes has strong implications for the way as the man interprets the world, society and itself [10].

The integration of ICT in the school did not constitute a process without conflict, nor produced the expected results. They represent new possibilities of (re)organizing work teaching but raised initially some questions [10].

It is necessary to deepen the questions and ask: How do ICT change (or can change) the nature of the goals educational covered by school? How do they change the relationship between students and knowledge? What way do they alter the relationship between students and teachers? How are they changing the way teachers live their profession? Is there emergence of the information society requires or not a new pedagogy? [10].

One of the most traditional attempts to explanation of these questions by the school uses
the Assisted Teaching Computer. The Aided Education Computer (AEC) had inspiration in behaviorist theory Burrhus Frederic Skinner (1904-1990) and conditioning working provoked by his "teaching machine". According to this theory, learning can occur through the application of exercise repetition and training. This strategy lead learning became known as Education Programmed.

Starting from years 1970 as O development of audiovisual materials more sophisticated, especially those produced by Computer, Education Scheduled been replaced by the Aided Education Computer (AEC). With strong influence and tendency to follow the Teaching Scheduled assumptions, the AEC turned out to not be sustained because when trying to imitate figure teacher, let out your real potential to assist the subject in his learning process.

In the AEC, the computer plays role teaching and tries to convey knowledge to students. In this perspective, the textbook is replaced by a succession of screens, static, repetitive and purpose of memorizing a "learning" pre-defined [10].

Under this view, the use of computer is of one garment which ultimately repeat the much criticized traditional education characterized the transmission and storage of information disjointed and meaningless to student.

Teaching by computer implies that the student, through the machine, may acquire concepts virtually any domain [5]. However, most often this is not use it realizes in schools.

When the computer teaches the student the computer assumes the role of teaching machine and educational approach is aided instruction computer [5].

As opposed to the use of perspective computer as a teaching machine, which supports traditional method of instructional teaching, this technological feature can also be used as educational tool.

The computer is no longer the instrument teaches the learner, but the tool with which the student develops something and therefore learning occurs because running one task for computer means [5].

The ICT must be understood as tools free and creative use by teachers and students and are inserted into an educational project focused on leadership and student learning [10].

It is the use of technologies that will cause the teaching and learning has better quality, but how this apparatus is used for mediates the relationship between students, teachers and the information. Interaction processes in education they relate more to people involved in these processes than with the same technology itself [4].

There is no room to discuss whether the school should or should not use the technology in the process educational. This debate is exhausted. THE discussion deepens and points to other reflections, now directed to the critical use and reflective technology to the difficulties found to integrate them to a project pedagogical wider and its articulation with the school curriculum.

3. Materials and Methods

It proposed an intervention project teaching the mathematics content with students 4th grade of a public elementary school located in the Midwest of Minas Gerais State, Brazil. This research is exploratory, presented quantitative approach, with nature descriptive. The universe of this research was composed by 22 students. The relationship age/school stage was adequate and the children were aged ranging between 9 and 10 years. All were beginners this school career step. It was proposed to students meet the challenges presented by software Tux of Math Command.

The 5.0 version of Linux Educational (LE), differentiated and made available by University Federal do Paraná (UFPR) has several applications educational that can be used in the context the classroom. By clicking on the "Linux button Educational "., which appears at the top left the room, three tabs are displayed: Windows, Applications and to seek contents Educational. The “Applications” option brings a series of educational software, including the Game Mathematics “Tux of Math Command” analysis object of this study.

![Figure 3.1: Applications Linux Educacional 5.0](image)

Tux of Math Command can be used in mathematics classrooms and is suitable for students who are starting to recognize the digits and for those who are starting or already perform the four basic operations: addition, subtraction, multiplication and division. In this experiment, the simple multiplication will be used with the number 5.

This software offers a number of options work mathematics. Among them, there is the possibility student play alone or challenge one of his colleagues. Importantly, the Tux of Math Command can be downloaded and installed also on Windows.
In this study, due to the need the researcher to monitor the performance of student, program was utilized individually, i.e., the student played alone and challenged the software itself.

By observing Figure 5, it is clear that the scenario where the game takes place is the space interplanetary. Game components can be identified by the numbers 1 to 9, the follows: 1) the student, represented by mascot Tux; 2) the laser gun; 3) the display that displays the result of the mathematical operation performed user; 4) the "four lives" the player and features that speak seven collisions of comets on the igloos, without the immediate elimination of player; 5) the comet that "threatens" the polar region, environment where Tux lives; 6) mathematical operation the comet brings, and that the user must solve; 7) Game Stage where is the user; 8) Remaining number of comets (and mathematical operations) that threaten the environment Tux; 9) score obtained by the user.

Figure 3.2: Interface Tux of Math Command

To play, the student (represented by the mascot Tux) must defend the polar region where he lives. For therefore has a laser tube to be fired on comets arriving from space and threaten to destroy the city of Tux. Each comet carries a mathematical operation the user must solve mentally (or orally, if you prefer) and enter the result in keyboard. The result entered by the student appears in Tux display. After entering the result of calculation, the student clicks on the "enter" key or "Spacebar" Tux cannon is fired and a tone sounds. If the result entered by student is correct, the cannon destroys the comet and learner proceeds to the next operation. If result is incorrect, the cannon fires to space, misses the mark and Tux gets upset.

Tux has "four lives" represented by 4 penguins in their igloos. The goal is prevent comets collide against igloos. Each igloo only supports a clash with comet. In the second shock, the igloo is destroyed, the Penguin was inside the igloo out of the game and, with this, Tux "lose a life."

You can recover "lives" during the game. For this, the student must get it right, then without no error, a certain number of calculations proposed by the software. If you can hit the series of calculations suggested a new penguin enters the game scenario, a cloud forms over it and then the snow is precipitated, forming a new igloo. At that time, the student achievement more a "life", extends their time to participate in game, with the possibility of making mistakes twice more without being eliminated.

Each time the game is started, Tux of Math Command proposes 44 challenges the student (math operations). To win, the user needs to go through seven stages.

As one phase is exceeded, increase number and complexity of the calculations. To winning stage 3, a red comet bringing an operation that the student missed or delayed solving approaches a certain igloo speed greater than the blue comets. If you hit the result of the operation and destroy the comet incandescent, the player is applauded and subsidized the score.

A situation where the user greater demand time to think and solve the calculations results in a greater number of bills submitted by program, requiring the player to reason with more quickly to avoid collisions.

To overcome all the "threats coming space" the user goes through seven stages packed by different songs that stimulate activity and desire to hit. Phase 1 presents two calculations to be solved; Phase 2 has four calculations; The Phase 3 launches six challenges; Step 4 triggers eight operations; Phase 5 suggests ten calculations; Step 6 calculations also provides ten and, finally, only four operations are proposed in Stage 7.

As the game progresses, the student advances to a new stage and the level of difficulty increases. Every overdue step, the scenario modifies, increases the speed and number of proposed calculations. After resolving all operations, the student wins.

3.1. Data collection

To gather the information needed to do the work, it was decided that only two data collection tools: observation not participant and the field diary.

Data collection began on 6.3.2016, with the application of a questionnaire to identify the learning style of the research subjects. Between 06/06/2016 and 10/06/2016, the information collected in the questionnaire were cleared and researcher identified learning style prevailing for each student.
The researcher used, beyond the logbook and the observation guidelines nonparticipating, a notebook, a stopwatch and a numeric keypad allowing the student to all the commands required to perform the test.

Figure 3.3: Equipment used

From 13/06/2016 to 17/06/2016 students underwent the game Tux of Math Command. To maintain the concentration and minimize interference from other students, teachers or servers, the student was removed from class and taken to the library to take the test. Each student was subjected five times to match in days consecutive.

During the test, and with the help of the script non-participant observation, the researcher collected and recorded the following information: number of hits, number of errors, and time (in seconds) used for the completion of the test and the score obtained by the student.

4. Results and discussion

In this section, the information obtained in the collection data is transformed into graphics, whose comments are presented below.

Graphic 4.1: Sex of participants

The group that participated in the survey consists for boys and girls. They collaborated with the study of 22 students of the 4th grade of elementary school. Most of them are men (59.09%). Girls represent 40.91% of the total students, as shown in Graphic 4.1.

Graphic 4.2: Age of participants

The period of data collection, the subjects of research had ages ranging between 9.3 and 10.2 years, with a predominance of students aged 10 incomplete as shown by the Graphic 4.2.

Graphic 4.3: Learning Styles

Answering the questionnaire of styles learning, we observed that the style auditory learning prevailed among research subjects (50%). The style visual learning prevailed in 27.27% of students and the kinesthetic style characterized 22.73% participants, as shown in Graphic 4.3.

Graphic 4.4: Class Average Score each sequence of calculations

The mean score of the participants during the five calculations sequence sessions can be seen in Graphic 4.4. The line-shaped ogive indicates that, every day that were subject to tests, the average number of hits increased considerably.
Graphic 4.5: Class Average time in each Following calculations

The average time that students spent for solving the following mathematical operations 44 no presented behavior uniform, according established fur polygon in frequencies plotted in Graphic 4.5. The best performance was observed on the second day test application (214 seconds). From the third day of observation, the average time began to decline, tending to stabilize in the best time achieved by proximity group.

Graphic 4.6: Class scoring average in each Following calculations

Analyzing the warhead of Graphic 4.6 is noted that student performance was regular, demonstrating a significant increase in each test which underwent. It can be inferred that each sequence of calculations, subjects increased their score.

To try to establish a mathematical equation that can translate the behavior between the two variables, or estimate the values of a variable (dependent), based on the values of other (independent), we use the linear regression. Thus, the values of the Y axis (variable dependent) are estimated using as a parameter the values of the observations recorded on the X axis (independent variable).

The joint behavior of two variables quantitative (independent and another, dependent) and your membership level can be demonstrated by means of two statistical features: the scatter plot to represent, in plan Cartesian data set, and the coefficient of Pearson correlation (R). The coefficient Correlation measures the degree of association exists between two variables. In this perspective, the variable independent tends to cause changes in value the dependent variable.

Graphic 4.7: Correlation hits and scores

The Pearson correlation coefficient (R) the variables “Average hits in each sequence calculations” and “average scores” was 0.9876. This value indicates high the significance relationship between them. Thus, it can be inferred that the two variables are correlated positive (straight upward), or as the number of hits (independent variable) increases, the student's score (variable dependent) increases in the same proportion, as shown in Graphic 4.7.

Graphic 4.8: Correlation time and scores

Another statistical model that we have created to try prove whether there is dependence between the average time that the group spent to solve the following and score calculation can be verified in Graphic 4.8. Given the Pearson correlation coefficient (R) for this data set (-0.9909), found an almost perfect relationship between the two variables because the points are well distributed along the straight, which results in a short detour standard data on the average. The correlation between these variables is negative, because the straight line equation has a descending orientation, i.e. The mean score increases as time used to resolve the sequence of operations decreases.

Table 4.1: Multiple Correlation

<table>
<thead>
<tr>
<th></th>
<th>Hits</th>
<th>Errors</th>
<th>Time</th>
<th>Score</th>
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<tbody>
<tr>
<td>Hits</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Errors</td>
<td>-0.99911</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>-0.96911</td>
<td>0.968688</td>
<td>1</td>
<td></td>
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<tr>
<td>Score</td>
<td>0.98783</td>
<td>-0.98589</td>
<td>-0.99065</td>
<td>1</td>
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</table>
To check whether there was a relationship between all variables in this study, as well as the significance of this correlation, we calculated the Pearson correlation coefficient (R) for each relationship and we found the data shown in Table 4.1. Considering “number of hits in each sequence calculations” as an independent variable, and knowing that R = 1 or -1 means perfect correlation, we say that the variables considered in study showed almost perfect correlation, positively or negatively.

The correlation “number of hits” X “number errors” shows a negative correlation almost perfect -0.99911. That is, as these variables increases, the other decreases proportionally.

The correlation between the variables “number of hits each sequence of calculations” X “time to resolution of the sequence of calculations” demonstrates a negative correlation high degree of dependence with value -0.96911. This means that the as the variable “number of hits in each following calculations” increases, the variable “time for resolution of the sequence of calculations” decreases on the same proportion.

For the variables “number of hits in each following calculations” X “average scores” we found a positive correlation great magnitude equivalent to 0.98783. Thus, as the variable “number of hits in each following calculations” increases, the variable “average scores” increases proportionately.

![Graphic 4.9: Correlation and learning style scores](image)

By correlating the learning style dominant in each subject with their mean score the sequences of calculations we concluded that participants who have style auditory learning exhibit the most scores low group. Proportionally, the subject with visual learning style portrayed best score, followed by students kinesthetic learning style, as shown in Graphic 4.9.

5. Conclusion

This study showed significant evidence that mathematics can and should be worked by through playfulness expressed in the various options games available in Tux application of Math Command, including the “challenge” between two students in solving the problems posed by program.

Tux software, of Math Command is more suitable for children with learning styles visual and kinesthetic. No deception, the game can and it should be used with hearing students. In that case, we believe that suggest the student to speak in aloud, the calculations can be solved improve its performance.

Their research shows that using pedagogic rated application contributed so much for fixing the results of the facts fundamental involving simple multiplication with the number 5, and to the development the students’ thinking agility. Verified this experiment encouraged students studying the multiplication table voluntarily, without requirement of the teacher and without character competition among students. Increase Progressive number of hits and the reduction gradual in time to resolution of the calculations certify and validate the importance of using the Tux of Math Command as a tool teaching to teaching and learning Mathematics.

The software evaluation in this research not replaces the role of the teacher as a mediator of the knowledge building process by student. However, if its use is well planned, it can be an ally meaningful to the teacher in exercising its teaching practice with the teaching of mathematics.

Explore other mathematical operations such as addition, subtraction and division, raising the degree of difficulty and complexity can, in studies future, present more surprising results the empirical findings of this study and contribute to the refinement of reasoning logical mathematician of children living this stage cognitive development.

6. Acknowledgements

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7. References


