What if You Created Your Own Digital Adventurers' Park?

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Abstract

In the ambit of a summer school, we have proposed to a group of nearly 40 students between 10 and 15 years old to create a digital adventures' park with Squeak. None of them knew the software nor had previous programming knowledge, and many had little over the basic competences for the use of a computer, though they showed a special interest in computers. In this text we intend to approach some of the attitudes demonstrated by the students in the face of the challenge proposed at the course and their imaginary's transposition to Squeak's environment, in an ecologic perspective of the media. We will pay special attention to creativity's emergency which seems to us anchor the development of object-oriented programming competences in inexperienced programmers. In addition we will also refer to the self-learning and collaborative learning aspects resulting from the interaction between "creators" and "programmers", in light of their importance in learning environments without a teacher.

1. Introduction

In Portugal it is becoming common the offer of free time occupation activities directed at potential future University students, in the period between the end of school classes and the parents' leaving for holidays.

At the University of Minho it is already a tradition to offer sportive adventures to the community, sometimes radical or with a taste of adventure, which end up being sought for by young adolescents longing to occupy their leisure time during the first weeks of July.

For the first time such activities proposed included a pedagogical component of the responsibility of the university schools interested in it, as it happened with Institute of Child Studies (teachers' initial training school) which, in articulation with the Competence Centre (support unit to the integration of new technologies in public schools), proposed an adventure which we named the "Digital Adventures' Park".

2. The Proposal

The initiative's main objective was to initiate the youngsters in programming an "adventure" with Squeak, but our knowledge of the conditions of how and the perspectives in which information and communication technologies (ICTs) have been introduced in schools have taken us to begin by proposing to the young participants the realisation of researches carried out on the Web to collect information which would be used in their own personal adventures' park projects, at the same time that we would emphasize safe behaviours for the use of Internet and the respect for copyrights.

The proposal of the use of an object-oriented programming system has to do with some of the ideas we have been developing in the ambit of the research in the area of children's initiation to programming and because we think that using computers since the early school years is fundamental to education, but we also know that, as Anderson [1] refers, some studies related with new technologies' integration "lead us to conclude that for some pupils, with some teachers, in some classes, in certain schools, some progress has been achieved, but evidence of transformation is only exceptionally [1].

In effect we have been assisting to an aggressive opportunity offer of computer use in an educative context, at all school levels. Almost every student has his/her personal computer, but the great obstacle to education's progress seems to be the inexistence of creative computer activities' proposals which cause children to be enthusiastic about learning. Even at the professional level the areas with greater need for good professionals are still computer sciences.

In a small 2003 article, Mark Guzdial and Elliot Soloway [2], basing themselves on specialists' ideas about the use of computers in learning, defend the precocious introduction of computer sciences in a liberal model of education, arguing that, to attract and maintain a larger number of students in this knowledge area, we have to alter pedagogy and, consequently,

what we teach. Although these authors' preoccupation was directed at higher education students, it seems indispensable to us to extend it to the younger ones, in agreement with the defence of computer initiation courses by objectives and that these should focus more on concrete themes rather than on abstractions. Some fundamental concepts and algorithms which come up in the concrete approach are not taught when other approaches are used, these authors continue. Nowadays it is not necessary to use the same examples to illustrate the same concepts.

Our worries (all immodesty aside) are of the same calibre as those expressed by Alan Kay [3], basing himself on Murray Gell-Man: the representation of ideas has replaced ideas themselves and "students are taught superficially about great discoveries instead of being helped to expand their knowledge by themselves".

Using, in an allegorical way, the saying that the pianist knows that music is not in the piano, Kay defends that teachers have to feed the romance of learning and expressing, fears to which computers can respond with even greater amplitude than pianos. Computers, unlike most musical instruments, have become, or can be, interactive, not simply reactive, Kay said.

We also believe that each generation should be capable of learning quickly new paradigms or points of view concerning the world because older forms cease to be usable in short term and it was in that sense that we have proposed the Digital Adventures' Park.

3. The participants

40 children have signed up for the Digital Adventures' Park, aged between 10 and 15 years old, forming two groups. Each group has developed its activities for a week, keeping mornings busy with computer activities and afternoons occupied with leisure and sport activities. Some of the students were already familiar, because they lived close or because they went to the same schools, but most did not, as we could observe in the relaxed presentation session.

Although they all liked to use Internet and computers a lot, many only had the basic skills, showing difficulties in performing researches using the most popular search engines or, for instance, in saving Web images to their own computers. Concepts related with copyrights or with what we can and how we can or cannot copy from the Internet were almost inexistent.

Their information literacy was far from what we would like to find in these digital natives, if we accept that the information literacy Anderson [1] refers to corresponds to the student's competence to selectively validate and interpret information from digital sources, relating it discriminately with what he/she previously knew and improving his/her posterior knowledge and his/her understanding concerning the world.

Although some of these students were capable of dealing with information without any intermediation, most need to learn how to do it and our challenge seemed colossal at the course's beginning.

4. Course's methodology

Since none of the young adventurers had meet Squeak before, the first session elapsed with the presentation of the software's interface and with the learning of the essential steps to create and save new projects and with the exploration of objects' selection techniques.

In general we started by explaining the group the activities' objectives as we realised their competences in the use of computers and their interests beyond school, trying to create a convivial and comfortable environment that would allow all of them to feel good. We believe that gathering a group, even if one of motivated children, to perform tasks in principle unknown to them is a serious handicap we cannot neglect. Therefore we have sought to create a culture, collective discourse and practice atmosphere which would allow each one to feel part of the group, in Nancy Ares' [4] perspective of ideas that inviting "students' engagement in practices that have links to youths' cultural communities" are crucial linkages for "increasing the inclusive, academically powerful potential of networked classroom activity".

Day 1's three-hour session just fled, leaving us rather concerned with the possibility we might not achieve our initial objectives. Children themselves were slightly disappointed because they did not see any signs of an adventures' park, in the idea's sense appealing to the common concepts of park and adventure.

Some of our monitors, young recent graduates, volunteers with the task of monitoring the children on every day of activities on campus, have turned up their nose at the initiative's success, dragged by their lack of experience dealing with children or drowned in the lack of knowledge of Squeak's real potentials. Their schooling had been a different one and maybe they did not believe that the "invention activities for children need not be limited to classroom exercises that can demonstrate certain competencies"[5].

Nevertheless, on the second day the youths quickly learned to import to their Squeak projects the images they had previously saved from Internet. We had suggested that they should look for images susceptible to be used as scenery's background and that suggestion started by generating a lot of indecision, because the

youths would always find an image more interesting than the previous one. Nevertheless that was the way for them to acquire skills and to get familiar with objects' import routines, having also had the chance to learn how to retouch images a little, by cutting them out or resizing them, according to their intuition, even without a defined use in their actual Squeak project.

The use of Squeak's drawing and colouring tool was but shown, because initially students did not see any exceptional utility in it.

On the third day (Wednesday) we suggested children to draw some objects that could move in the habitat, by using the Squeak paint tools or by importing images to their project, according the background image they choose previously and gave them the opportunity to explore some techniques of drawing on Squeak.

Generally all youths repeated their researches in the search for background images closer or more adequate to their playing tastes, being possible to see that boys looked for background images more similar to video game consoles whereas girls would opt for images of habitats commonly associated with the traditional feminine imaginary.

As students inserted movable objects, we would show how to create a script with displacement and rotation movements, leaving to each one the decision to use them or not in their respective projects.

We realised here the evidence of the *learner construct* that Druin & Fast [5] acknowledge when children show "that they are absorbing, understanding, and making sense of the process of invention."

Little by little they created and combined scripts freely. Some opted by reproducing common sceneries and events, such as the beach, the sea and the leisure parks they should be dreaming about at this Summer time of year. Others have adventured into the imaginary of the fairish and fictional space or of the dream cities of all of us. Many quickly understood that those scripts lacked answers to their ideas, asking us questions related to events' control, to speed and direction changes or the use of *if-then-else* conditional structures, as if they already were real programmers.

This behaviour reminded us of Guzdial & Soloway's [2] observations that, knowing the software's potential, students can envisage constructivist forms of learning, improving their knowledge about subjects they are studying and developing the collaborative work skills. Basic skills' control allows them to select the resources and information sources to be used according to the importance they give to subjects, as they evaluate how far the information they find provides an answer to the problem or to their initial questions.

Even if not all of them were aware of their progression, in terms of reasoning and logic structures, they were happy and began to comment on others' works, showing, proudly, what they had accomplished in such little time. In each group we could observe that some had completely fallen in love with the work and, even if the digital adventures' park was not constituted by expensive last generation video game consoles, the fact that they were creating their own toys took us back to the time when we also created the wire cars that we would then luxuriously drive in front of our play pals, two generations before.

We here notice the *construct of inventor* that Druin & Fast claim to appear when children show "that they are suggesting new ideas to be invented that have not necessarily been thought of in a particular way before. Many times, with this construct, children have an expectation that the research team can actually invent their new ideas" [5].

Some would be satisfied with the simple movements their hero-objects would perform, but the majority of them wanted to introduce more complex situations, including the objects' motion, asking us if they could not control them with keys, for instance, as in some Net games. It was then the time for us to present the Squeak's virtual joystick, which, though merely virtual, was then part of a great number of these young programmers' project's worlds.

As each one defined the general theme of his/her adventures' park project, we were faced with questions, doubts and Squeak's own error messages which forced us to explain that the system is completely open and when errors occur it displays messages so that we can correct them. Sometimes we reached a debate which was not in the plan, forgetting ourselves that we were talking about computers for only three or four days and that we were all adventurers' apprentices. Our contenders were young teens who thought they knew nothing about programming!

Once again, Druin & Fast [5] help us to recognise the *construct of critic* observed when children show us in their projects "that they are recognizing what is good and bad in inventions around them." Strangely, unlike what happened with adults in previous experiences, students tend to understand some of the software programs' anomalous behaviours, if they understand that such behaviours are genuine, deliberate and that such events are opportunity windows to learning.

5. The projects and the interactions

Given the familiar atmosphere we were able to create, in spite of the fact that each student had his/her own computer, they exchanged ideas with their neighbour almost all the time, or, in some cases, with almost all other participants. The need to assess their

projects' quality regarding their partners' tastes and criticisms was much more evident than the soft criticisms we would carefully make to their projects.

One of the students had, inclusively, two projects: one for us – *the grown-ups* – and another for his school partners. The grown-ups' project was a Sixteenth Century Portuguese Discovery trip, subject that impressed him at school and that he considered to be important to represent in a Squeak project. The other project was related with surfing and with the challenge of swimming in a sea of sharks. This student, one of the youngest, revealed some focus and work persistence problems, but unbelievably, when we thought he was daydreaming, he was in fact following learning in general. We observed this younger giving advice to other colleagues, including on how to increase the speed of object's movement and how to control the script with mouse click, for example.

Also self-comments we listened along the way were generally satisfactory and enthusiastic:*"When Vito sees it, he's going to flip!"* Their relation with the computer's screen and the ideas which eventually filled his ten-year-old spirit did not allow him to be satisfied with the results obtained, within an apparent contradiction between plenitude and the challenge of progression.

Another student, one of those we immediately recognise as a future expert, has planned an adventure in a volcanic environment, mixing risk and nature's power with the challenge to escape the place, by driving a car with special characteristics, in a peremptory confirmation of Turkle's [6] words that "the gears of a toy car introduce the chain of cause and effect to artificial intelligence pioneer Seymour Papert".

Another young programmer put himself to a thorough task of reproducing a war game scene, probably inspired by the video game consoles he amuses himself with.

Figure 1 – *Paraiso Warrock [Warrock Paradise]*, Tomás, 14 years old

These youths' creativity did not stop them from representing alien beings in exploratory visits to our planet, or from recreating interstellar trips or very dangerous mountain climbing.

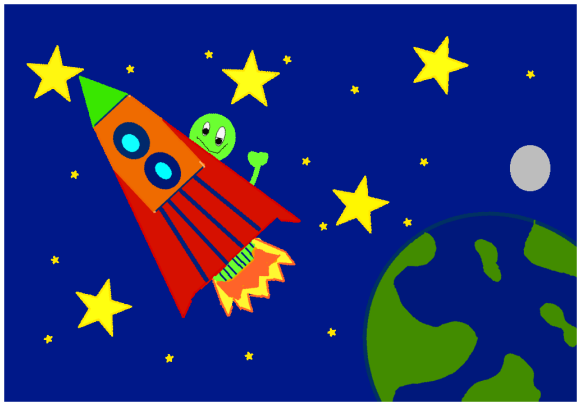

Figure 2 – *The Universe*, Rita's project, 13 years old

Obviously, in a universe of forty children that, after all, had their first contact with Squeak and produced a project within less than fifteen hours, it would not be expectable to find programming master-pieces, but the results are less important than the learning processes we were able to see for ourselves. Nevertheless, some of the projects are flashy, as we can confirm in figures 1 and 2.

As it may have already become clear, our form of intervention had a period in which we played an orientating role, at the beginning, and then an advising period, by our own initiative or that of the students who asked us questions. However we have always felt partners and the young programming apprentices acknowledged us that personification.

They were always concerned with asking us whether we agreed with the decisions they had made, whether we would like the colours and the ideas they had transferred into their adventure projects. Sometimes they would adopt a defensive position, alerting us to the fact that they still knew little or that they had not been able to put into practice all of their intentions.

The *construct of design partner* that Druin & Fast [5] tell us about when children show "that they can work with others in the invention process, whether it be adults or other children, in a collaborative way" has become evident in our observations.

In many cases, the students ended up turning their projects much more complex than what we expected and would be necessary or demandable, in an attitude we interpreted as a need for demonstration and a test to the knowledge acquired. The pride Squeak allowed them to appropriate, making them pretend to be programmers, was one of the characteristics that impressed us the most and encouraged us to divulgate.

Also impressive was the youths' progress from the third session, when they started to be in control of the software, to create projects in parallel and to intentionally move their interest's focus away. Some of them have put aside the simple and naive project we had proposed to them and have launched themselves into the creation of complicated interactive interfaces, clearly showing that, when they have the control of the alternative tools', the answers they seek are not being provided by the school they attend.

We also noticed, as well as Druin & Inkpen have observed in 2001 [7], a perceptible disconnection between what school technologies provide children with and that which is their world, very diversified and extremely active. The notorious absence of an answer related with the youngsters' social experiences becomes more vehement in the fact that technologies do not foresee the really cooperative use of equipments nor the simultaneous use of several marking devices, for example.

On the one hand, we emphasize the support to learning based on constructivist models, but we do not have resources that go near the children's typical "unordered" way of being, their interactive, inquisitive and explorative nature. The certainty that it is necessary to go beyond an adult-centric vision of technology and to adopt personal technologies which allow children to be what they (may) want to be is way distant from what we do to accomplish so. As Druin & Inkpen state, it is expected that future technologies be concerned with a social awareness's development, that they promote the playful creativity and active exploration, that they become unisex and intergenerational technologies to make it possible also for parents and children to learn and play more with each other.

The answer technologies (do not always) give to children's needs, shows identified by many of this field's researchers as one more problem. For instance, in 2004 Mitchel Resnick wrote that "the problem is with the way that creators of today's edutainment products tend to think about learning and education. Too often, they view education as a bitter medicine that needs the sugar-coating of entertainment to become palatable" [8]. Nevertheless, Resnick goes on, "they provide entertainment as a reward if you are willing to suffer through a little education. Or they boast that you will have so much fun using their products that you won't even realize that you are learning—as if learning were the most unpleasant experience in the world."

On the work day before the last one, the natural hustle and bustle around the projects even stopped the youths from taking a break. Some even renounced having the little snacks they had brought from home; such was their enthusiasm around their creations and the worry to conclude them before public presentation. In a very typical and frequent attitude, they made mutual compliments regarding each other's projects and they would try them under the respective authors' orientation. We can confess that we also learned a lot with this exceptional experience, but we are incapable to anticipate the experience's impacts these youngsters have been faced with.

Maybe not all of them valued the learning they had accomplished, but, on the last day, when we presented the projects at the University's auditorium and we realised that some of them were overwhelmed, mixing that with the butterflies-in-the-stomach feeling that one has when one loves something one has done but fearing others will not feel the same way about it, we felt the digital adventures' park was finally open.

The reactions of the adults present there, parents and other teachers who did not hesitate to state having noticed in those youngsters' works the manifestation of skills hardly found among young university students of the computer science courses, comforted the insecure authors who stood incredulous in the audience.

6. Conclusion

Apparently, children can absorb computer programming concepts and principles with great easiness and security, even if school insists in ignoring their value.

Even if education has been evangelised with the constructivist contributions from Papert and Alan Kay, even if it has been assumed that the two main forms the ICTs have to bring changes into any organisation are: through the automatisation of the existing practices without necessarily adding value to them or through their information and transformation, thus allowing new forms of information access and new practices' creation, as Zuboff [9] states, we continue to preach that school is preparing itself to answer students, but we doubt they are willing to wait for the answer.

In many cases, the students themselves take the step in using technologies to disintermediate, that is, to elude school and curricular control in what refers to their access to information [1]. To take advantage of that self-determination in the digital era is a challenge as complex as creating any digital park, but which can simplify itself if we leave it up to children to build their own adventures. A little like the testimonies we have read from Sugata Mitra [10], it seems to us that if we are not capable to teach students to program, since the early school years, we can at least adopt *minimally invasive education* principles.

We must create holes in the walls of the education building and fill them with computers with tools that

fire up the creativity, because the greed for discovery that all children show will be in charge of giving them opportunities that the curriculum system is denying them.

To allow young computers' enthusiasts to build their own adventures' projects, using software like the one Squeak represents, can be a strategy to "fire imagination and set young people on a path to a career in science" [6].

In these ten days of contact with these young people, we could observe their strategies for immersion in the new toy that was Squeak, first comparing it with their other digital "toys", then exploiting it to dominate, revealing an attitude of supremacy face to the machine, pointing to weaknesses of the operating system and suggesting features that they had not managed to discover and finally, "undermining" the system to create the same games that they are playing at home or on the street.

The greatest creativity always appeared in the reorientation of the answers that the software gave them, demonstrating enough cognitive flexibility to adapt the characteristics of the environment to their development objectives without disinvesting in their projects to fit the characteristics of the software.

The exchange of views and praising among young people is much healthier and more genuine than the interactions between adults and maybe this aspect will serve as the leading force so that everyone can keep itself on the learning front. If a student finds a solution, the first thing he/she does is to reveal it to everybody and when he/she realises that a partner is in trouble, he/she gives him/her a piece of advice. We have seen these gestures repeatedly, and we all seemed happy to be like that. Sometimes they gathered around to watch the success of a partner piloting a small boat in an estuary full of small islands, using a joystick and they would ask if there could not be more boats and more joysticks, of course! Sometimes the partners would suggest that they added a detail or a pirouette to the objects in their projects' world.

We were surprised by a strong tendency to create complex projects, a kind of attitude challenging their creative abilities in contrast to the system's responses.

These young boys and girls who like computers and music, all kinds of music, also know that music is not in the instruments, or that creativity is not in computers or in software, and thus they demonstrated that they are capable of learning to program faster than we are able to teach them. They only need their "hole in the wall", as Sugata Mitra observed.

7. References

[1] J. Anderson, "The Changing Culture of Teaching and Learning," in *Education 2020: A Millennium Vision: Issues and Ideas for the Future of Education in Northern Ireland*, J. Gardner and R. Leitch, Eds. Belfast: Blackstaff Press, 2000, pp. 159-168.

[2] M. Guzdial and E. Soloway, "Computer science is more important than calculus: the challenge of living up to our potential," *ACM SIGCSE Bulletin,* vol. 35, pp. 5-8, 2003.

[3] A. Kay, "Computers, Networks and Education," Squeakland.org, 1991. Available: http://www.squeakland.org/school/HTML/sci_amer_article/sci_amer_01.html.

[4] N. Ares, "Cultural practices in networked classroom learning environments," *International Journal of Computer-Supported Collaborative Learning,* 2008.

[5] A. Druin and C. Fast, "The Child as Learner, Critic, Inventor, and Technology Design Partner: An Analysis of Three Years of Swedish Student Journals," *International Journal of Technology and Design Education,* vol. 12, pp. 189-213, 2002.

[6] S. Turkle, "Introduction: Falling For Science," in *Falling for Science: Objects in Mind*, S. Turkle, Ed. Cambridge: The MIT Press, 2008, pp. 3-38.

[7] A. Druin and K. Inkpen, "When are Personal Technologies for children?," *Personal and Ubiquitous Computing,* vol. 5, 2001.

[8] M. Resnick, "Edutainment? No Thanks. I Prefer Playful Learning," Associazione Civita Report on Edutainment 2004.

[9] S. Zuboff, "The Emperor's New Information Economy," in *Information Technology and Changes in Organizational Work*, W. Orlikowski, G. Walsham, M. Jones, and J. DeGross, Eds. London: Chapman & Hall, 1996.

[10] S. Mitra, "Minimally invasive education: a progress report on the "hole-in-the-wall" experiments," *British Journal of Educational Technology,* vol. 34, pp. 367-371, 2003.