Developing creativity, leadership and collaboration in a 1:1 environment

Cesar A. A. Nunes[1] **and Renata Ikeda**[2]

[1] Oort Tecnologia and Núcleo de Pesquisas em Inovação Curricular, USP, Brazil, cesaraanunes@gmail.com
[2] Colégio Santa Cruz, Brazil, renata@ikeda.com.br

Abstract: In a 1:1 environment it is possible to redesign teacher and student roles and their relation to knowledge and skills development. This paper presents the results of a series of classes focused on the development of some of the so called 21st century skills: creativity, leadership and collaboration. Eight years old students worked in small and large groups and a brainstorm tool was used. Self-assessments and reflections were registered in ThinkQuest Project, a collaborative workspace. Results show skills development and kids aware about their own skills levels.

Keywords: 1:1 computing, skills, creativity, leadership, collaboration, collaborative workspace

1. 1:1 Models

The creation of programs like OLPC (One Laptop per Child) and similars in many countries (e.g. "UCA – Um Computador por Aluno" in Brazil) generated renewed interest in questions like mobility, student centered teaching approaches, digital gap, anytime anywhere access, etc. The prices of new generations of lighter and wireless equipments like XO, Mobilis, Classmate, eePC,etc. reached a level that motivated the creation of pilot projects by many governmental agencies and NGOs.

Results of the pilots using the new equipments just started to appear and, in most cases, are largely qualitative indicating increase in students' motivation and new dynamics in the classroom. More detailed results on the impact on learning investigated from the use of older laptop models in a one to one relation showed mixed success depending very much on the way computers were integrated to school's life – planning, teacher training, curriculum integration, suitable software, educational policies ...

Increasing computing power and Internet connectivity of "pocket" devices like cell phones may help to consolidated a culture of using mobile technologies

for learning. According to Shuler (Shuler, 2009) the key opportunities in mobile learning are:

- encourage "anywhere, anytime" learning
- reach underserved children
- improve 21st-century social interactions
- fit with learning environments
- enable a personalized learning experience

Below in this paper we present an experience that explores the last three items: 21st century social skills, integration to old learning environments and build of new dynamics, personalized learning.

2. 21st Century Skills

The so called "21st century skills" are not new but become particularly important in this century. There is no consensus in listing what the 21st century skills are, e.g. the Framework from the Partnership for 21st Century Skills (Framework Partnership, 2007) and the competencies defined by OCDE (Definitions OCDE, 2005). However, there is no disagreement that among the skills one should have:

- problem solving
- critical thinking
- creativity
- collaboration
- autonomy

It is also acknowledged (Silva, 2008) that 21st century skills development does not have to happen after basic or routine skills have been acquired but instead may happen concomitantly to them.

The development of the 21st century skills is favored in student- and community-centered approaches. However, Bransford et. al (Bransford et. al, 2000) argument that beyond student and community one must have environments that are at the same time knowledge and assessment-centered. That means, skills are developed in a much interconnected way while also understanding content subjects.

If one takes the definition of understanding from Perkins (Perkins, 1998): "understanding is the capacity to think and act flexibly with what one knows"; one concludes that for a student to show understanding he must be given opportunities to apply and develop what he is learning. It puts students´ performances up in front of the teaching processes and happens more naturally in inquiry based, problem based and project based learning. A recent and extensive compilation of detailed studies (Darling-Hammond, 2008) present good results on students performances using such open approaches.

In the Teaching for Understanding framework, enhanced by technology (Wiske, 2005), it is argued that educational objectives made explicit for the students and continuous assessment are also important. It goes in the same direction as demonstrated by the research of William on formative assessment, the regulation of learning and its impact on students' performances (William, 2007). Key to students' success is the development of metacognitive thinking skills (Tishman et al., 1995 and Nunes et al., 2003).

3. Tools and Digital Workspace

It is knows that the 1:1 computer student ratio and good wireless Internet access is far from being a reality in most schools. However, it is important to ask ourselves: why should we pursue such configuration? What are the benefits? In this paper we argue that it is not only the 1:1 ration and Internet access that is important. The adoption of a collaborative supportive environment is crucial to go beyond usual practice and furthermore, if one devise goals like the development of 21st century skills, it is desirable to have tools and strategies that enhance students thinking in such a way they become metacognitive on their own skills development.

There is a long tradition on the development and use of computer supported collaborative learning (CSCL). The pioneer Computer Supported Intentional Learning Environment (CSILE) led lately to Knowledge Forum (Scardamalia, 2005), FLE3 and inspired many others. Nowadays Learning Management Systems (LMS) like Moodle and Blackboard incoporated collaborative tools like forum and wiki and, besides the initially designed use for distance courses, have been used by many schools to support collaboration in local situations.

The turning point for the contribution of mobile computers is not their mobility, but instead their capability to be integrated in a very low intrusive way in the dynamics of good teaching-learning processes in a classroom. By good teaching-learning processes we mean the combination of diversified activities in which students work alone, in small groups, in large groups to raise opinions and connect new ideas to old ones, to search, organize and assess information from different sources, to discuss and debate, to assess themselves and their peers, to improve ideas, to synthesize and, as a group, to make reflections and conclusions.

According to Vivancos (Vivancos, 2008) one can identify phases in the history of the use of technology in education. It has been a passage from a complementary use to the curriculum – courses and training about operational systems and tools - to a supplementary use – the same old activities only with a "technology dress" – to an integrated use – new activities, not always particularly meaningful for learning, driven by technology – till an impregnated use – technology used in a

transparent way and only when it enhances learning. Small and mobile computers in principle facilitate the achievement of the "transparent use" of technology in a sequence of designed activities with and without technology (Koper, 2001), with the technology being used only when it actually enhances learning.

The above expectations of transparency and flexibility, when combined to the goal of knowledge building (Bereiter and Scardamalia, 2005), development of 21st century skills, and the actual dynamics and rhythm of work in a classroom impose some conditions on the tools and infra-structure:

- digital workspace to quickly raise new students ideas and to identify participation
- instantaneous visualization of own and colleagues entries
- easy of use to create in the workspace new "on the fly" activities reacting to opportunities and new situations
- multimedia projector or digital whiteboard to support whole group discussions, synthesis and conclusions mediated by the teacher.

It is common that in inquiry based learning only a few, and always the same, students participate - they are faster and less shy than others. With the use of a workspace that allows to collect individual student ideas in a short time it is possible for the teacher to identify good opportunities, either because students present good ideas or because they explicit spontaneous conceptions that must be overcome. In either way the role of the teacher is to afford that every student "publish" his idea in the workspace and to read them while the students publish. A workspace with the capability of instantaneous publication allows the teacher and students to refresh their screens to follow each others´ ideas. Since every student writes their ideas, answers, opinions before reading colleagues ones, they are authentic and not influenced by others. Since participation is identified it is also possible in some occasions to ask and wait students that did not publish their ideas to actually write.

The way schools and classrooms are organized must be considered when choosing a good workspace to building knowledge and developing skills. In the case study described in the next section the ThinkQuest Project environment was used (http://www.thinkquest.org), a free environment maintained by the Oracle Education Foundation restricted to schools. It has some particular features that match what was said above:

- it is very easy to create a workspace for new activities (the workspaces in ThinkQuest Project are called "projects" even if they do not have the structure of projects);
- it is very easy to include all students from a classroom to participate in the workspace – they are "members";

- it is easy to create on-the-fly new activities using interactive tools available in the environment (debate, brainstorm, idea sharing, vote, and question);
- when students do insertions in the interactive tools their participation appears visually organized, identified and instantaneously published.

The aim of the implementation described in this paper was to explore not only knowledge building but also to explicitly help students to develop creativity, leadership and collaboration. Besides the ThinkQuest collaborative workspace we introduced a new tool in order to increase students' metacognitive thinking about these specific skills. The tool, a brainstorm tool for small groups, was developed recently by one of the authors of this paper and this was the first actual use of it in classroom situations.

In the tool students indicate themselves who are the members of the group that are going to participate in the brainstorm, they insert the "subject" of the brainstorm, and oriented to build relationships of speaker and annotators (the idea is that when someone of the group is speaking another member of the group, e.g the next seated one, insert a key word that helps them remember what he talked, but this member also classify the speech according these criteria: new idea, comment in support of a previous idea, comment against a previous idea, a generic idea that is not related to the subject of the brainstorm). The tool is not intrusive since who is speaking has no worry about registration, but students start paying attention to "new ideas" and "expansion of ideas".

After finishing the small group brainstorm students are oriented through tool instructions to classify themselves and colleagues in an increasing order of "effectiveness" for the group discussion. After classifying participation they give a feedback for the colleagues, as well as for themselves, on what could be improved for the next brainstorm session (not to be so oppressive, to be more focused, to be more talkative, to be less talkative). This tool was originally developed to be used in PDAs, but since it is Internet based it runs smoothly in notebooks and netbooks (one per group) in a non intrusive way.

The tool comprises also different visualization options: following the chronological order that ideas were presented; by student; by the type of ideas (new, in favor of a previous one, against a previous one, or generic); by the classification of effectiveness; by the feedback of the colleagues. The aim of all these visualizations is to promote thinking about creativity, collaboration and leadership during the brainstorm processes. It is expected that the teacher presents the information collected from the different groups in a whole classroom section using the multimedia projector and discuss the possible interpretations of the data. In the next section of discuss the impact of the use of such tool in a case study.

4. A Case Study

The case described here was conducted in a private school in the City of Sao Paulo, Brazil. The classroom had 25 students, there was one Intel classmate for each student and good wireless access to the Internet. The ThinkQuest Project collaborative environment was used and also the small group brainstorm tool described above. Students were eight year old, at the third grade, and the main subject they were studying was "water".

There was a mix of activities (search, discussions, brainstorms, preparation of a final product, knowledge talk, skills talk) that were not always supported by technology. The whole work took more than three months and it is reported here some of the moments where technology played a fundamental role. Concerning the technology, besides a continuous use of interactive tools in ThinkQuest Project, a multimedia projector was also used and in three moments the small group brainstorm tool.

The launch activity was a sequence of questions that students answered using ThinkQuest. Students followed each other participation by refreshing their screens and after a while the teacher commented the answers and posed a new question. The questions for this first class were: Why water is so important for us? What are the problems related to water in our planet? What can we do to minimize such problems? Where is water in our planet? Do you think we can go out of water? The teacher posed the questions in a flexible way. She noted from the answers and discussions from a previous question that she could go into a new direction. The second question was posed using the "debate tool" of ThinkQuest. It allowed the students to compare answers and they were eager to see the participation of everyone to know the "result" of the debate – there is a counting for each position in the tool. At the end of this class, still using the an interactive ThinkQuest tool they publish their own reflection on what they learned at that class.

At the end of this first class students were so motivated by the pace and participation that they said they wanted to work always that way, no more papers and notetaking. Students used computers in several other moments, e.g. to do searches in the Internet. Such technology use was intertwined to non-technology activities like expositive classes, search in the library, group discussions, etc. The subjects explored were localization of water sources, water cycle, ways to spare water, ways to clean water …

As a final product students had the task to produce informative paper toil to cover tablets used in the lunch cantina at the school. This way they could "transfer" their newly acquired knowledge to other students. The challenge was that they should synthesize the most important points of what they learned because they would produce just one common toil. They had limitations in the space and had to decide

as a group what were the most relevant information and messages they wanted to put in. This was the first occasion students used the small group brainstorm tool. Each small group came up with the group's idea and they tried to decide together.

The teacher looked at the participation registered at the brainstorm tool and, using the multimedia projector, talked to the students about the feedbacks they received from colleagues and called their attention to collaboration, creativity and leadership during the negotiation process.

To feel the impact of the use of the brainstorm tool the teacher used it in two other different situations, not related to the subject "water". The results showed that all students that received a clear feedback (the majority of the colleagues in the group gave the same feedback, e.g. to be less oppressive) changed their behavior and in the other round got different and more mixed feedbacks.

Such results were crossed with students' opinions. They published at ThinkQuest their self-assessment on group participation along the whole semester and described what would be the "ideal group participant". They were very sincere and did precise self-assessment pointing their weakness and what they should do to improve. Some classes later they published in two activities: what did I learn about teamwork and technology; and what did I learn about water and ways to minimize problems related to it.

The spontaneous answers contain phrases like this: "I learned how to join ideas and work better in a group"; "I learn how to improve ideas. It is nice that in a group you learn with yourself and with your friends"; "I learn not to behave like a boss in the group because my colleagues said what they thought about me", etc. The number of phrases related to the feedback received from the colleagues (not to be oppressive, to be more talkative …) is very large. At the same time, they report a huge satisfaction to have participated at the "project" and to have received and given feedback. They really appreciated and felt they learned a lot.

5. Conclusion

Computer in a 1:1 ration to students may be a marvelous ingredient in building knowledge and developing skills. In this paper we showed that the infra-structure alone is not enough to reach such goals. It is necessary to consider different dynamics – individual, small groups and large groups – necessary to develop skills like collaboration and leadership. It is furthermore important to have non-intrusive and flexible tools like collaborative workspaces that register and allow for visualizations of individual student's participation. Using a case study we showed some activities that lead students' attention to skills like creativity, leadership and collaboration. We showed that the development of such skills may be further

supported by specific tools designed for that, providing visualization of participation and colleagues' feedback.

From the results reported here eight year old students were able to build knowledge in a specific subject while they also developed their skills of collaboration, creativity and leadership. Students were very aware of such skills development, reported themselves they improved on those skills, and liked it!

Such results depended very much on a transparent and non-intrusive use of technology immersed in other non-technology based activities. Such integration was possible due to the adoption of mobile computers in a one-to-one ration.

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