

Social factors affecting the design of CSCL environments: preliminary observations

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Abstract. We performed a multi-week field test of software intended to allow children to create electronic versions of dramatic presentations. Eight girls ages 10-12 participated in creative drama workshops and were invited to create plays using the software. Detailed observation of their behavior during their use of the software exposes several obstacles that our future design must overcome. For example, tensions arise due to differences in perspective that are perhaps due to developmental stages; the things that are important to children in each stage vary and seem to inhibit communication and reflection about dramatic ideas. In general, children like both the concept of the software and the process of creating a digital play, as can be seen in their answers to post-workshop questionnaires.

Keywords: computer-assisted drama, developmental stages, conflict resolution.

Overview

Our overall goal is to create a Virtual Forum Theater (VFT) application that allows children to create electronic dramatic presentations. Based upon Bertold Brecht's Epic Theater (1964) and Augusto Boal's work on the Theater of the Oppressed (1974), this application is intended to provide a safe environment in which children can explore and react to oppression and conflict. This application includes a face and storyboard editors. For this paper, we studied children's interactions with these editors, in an attempt to learn how to improve the editors and create a better overall experience for the children.

This paper reports upon a three-week qualitative study of how children interact with two modules of Virtual Forum Theater (VFT) we have been developing, Dramatic Faces (DF) and a GUI storyboard. The purpose of the study was to better understand how children engage with these tools and what issues arise when they are used. We describe how the children made use of the tools and discuss whether the tools provide them with desirable learning

experiences in playwriting, planning, artistic expression, and team collaboration. Based on this experiment, we discuss how the tools should change in order to provide a better experience.

In semi-structured afterschool sessions, children used these prototypes to create dramatic scenarios. We were particularly interested in how the tools reinforce or obstruct target behaviors, such as children's abilities to identify, recognize, and respect others' points of view; and solve personal and community conflicts. We were mainly interested in three constructs that are attributes of their behavior, including expressive fluency, critical awareness, and conflict resolution. Expressive fluency is the ability to express emotions through acting, drawings or playwriting. Critical awareness is the ability to process and question any information received by someone else, as well as the knowledge being incorporated. Conflict resolution is the process of creatively resolving a struggle or disagreement between people in real life or on stage.

The main purpose of VFT is to build a safe virtual environment in which to express ideas, problems, and solutions that one's culture or peers may be actively repressing or suppressing. The DF interface is intended to contribute to safety by preserving the anonymity of each play's actors and authors. Solving negative conflicts face-to-face might be scary to children, and coming up with new ways to solve problems may be an intimidating process. Virtual anonymity may also overcome social obstacles such as shyness and peer pressure or expectations. There are also legal issues and limits upon public access to personally identifiable information for minors. The DF program provides cartooning image options for creating an anonymous and safe virtual play. At this phase of our prototype, we do not have the virtual component implemented; therefore, the results of this qualitative research refer to

the standalone interfaces.

The computer interfaces

The Dramatic Face interface provides an environment where children can modify (tweak) a pre-drawn “cartoon” face in order to give it a desired expression or depict a desired emotion. Tweaking involves placing a mouse cursor over a facial feature, holding down a mouse button, and moving the mouse to change the feature’s shape. The lines describing a given part of the face – such as an eye, nose or mouth – behave like rubber bands when the mouse pulls upon them.



Figure 1. Sequence of three dramatic faces

The GUI storyboard interface provides an environment where the learner creates “scenes” by selecting sequences of images to depict action and recording a spoken “line” for each sequence. A digital play is created by selecting a sequence of scenes. In the current version of the software, the storyboard interface does the playback and is limited to use on one computer at a time. We plan to develop further software so that the sequence of images and voices can be played as an animation in Real One Player™ on the Internet, so that groups of geographically distributed children can interact and modify the play simulating different solutions to the same conflict (Cavallo, 2004). A scene can be created using digital photography or digital dramatic faces.

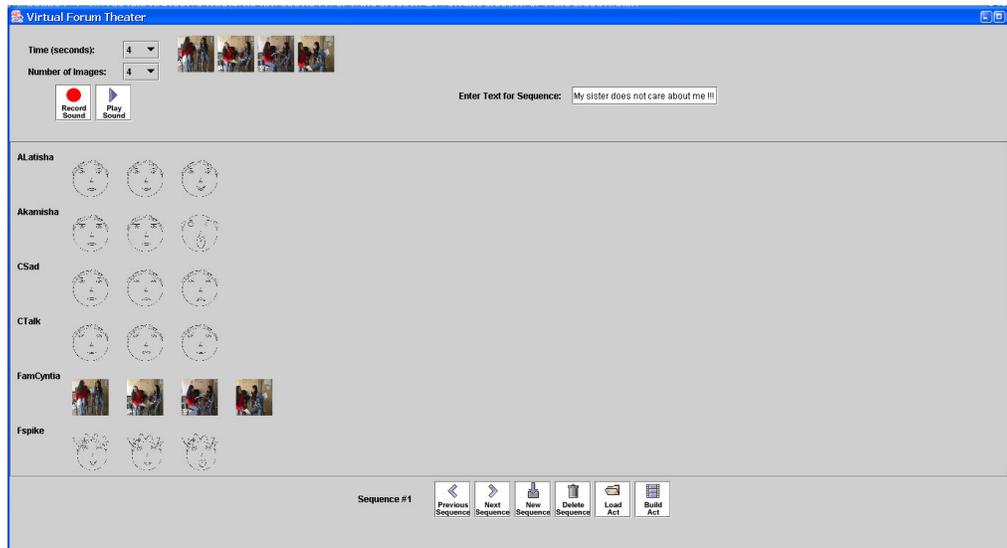


Figure 2. GUI Storyboard

Conceptual Framework for Our Analysis

Paulo Freire in *The Pedagogy of the Oppressed* states that “the humanist educator takes the role of the students’ partner and engages together with them in critical thinking, trusting men and their creative power” (1972, p.62). One of our basic premises is that the teacher should work together with her students as a peer and, albeit more experienced, partner in learning how to learn, building critical thinking and creative skills. We would like to see teachers and students teaching each other, a process that is mediated by the world through their dialog, inquiry, learning by doing, and being conscious of their realities in order to act upon them (Freire, 1972).

One way to support students in acting upon their world is to design a learning environment in which they can learn by doing, discovering and practicing ways to transform or improve their world. In his research on Emergent Design and Learning Environments, David Cavallo (2000) demonstrates how computers can extend Freirean ideas by augmenting the materials for conversation with one's environment. The environment should foster richer and deeper

interactions between students, teachers, and the reality surrounding them (Papert, 1980). Ideally the learning environment should be similar to an arts studio, where the students are allowed time to think, to dream, to gaze, to get a new idea and try it, drop it or persist, time to talk, to see, and to react to each other's work (Harel & Papert, 1991).

With proper safeguards and tools, online anonymous digital plays can provide a safe environment for solving dramatic conflicts, exploring oppression issues, and coping with unfair behaviors, as well as a place to enhance conflict resolution and argumentation skills. On-line simulations provide a non-physical environment where one can take risks on relatively safe ground (Ackermann, 2004).

The socio-constructivist psychologists and educators such as Vygotsky (1978), Doise (1984), Perret-Clermont (1980), and Lave (1991) claim that learning is social, and they investigate the cognitive value of peer interaction. Perret-Clermont (1980) concludes that peer interaction enhances the development of logical reasoning through a process of active cognitive reorganization induced by cognitive conflict. She also claims that cognitive conflict is most likely to occur in situations where children with moderately discrepant perspectives (e.g. conservers and transitional subjects) are asked to reach a consensus. According to Doise (1984) intelligence is not just an individual property but also a relational process between individuals constructing and organizing their actions upon the physical and social environment together. He argues that the interaction between peers enables the child to master certain abilities, which allow her to participate in more complex social interactions, which in turn promotes continued cognitive development — all happening in a circular process.

The learning afforded by VFT is social by design; therefore, all the premises explored by the socio-constructivism as well as Computer Supported Collaborative Learning (Koschman, 1996) paradigms apply to our study. Children work in groups, negotiating meaning, taking different roles in their collaborative stories, swapping points of views and elaborating argumentations to justify their choices and to solve conflicts. Doise and Palmonari (1984) believe that development is socio-constructivist: "...it is above all through interacting with others, coordinating his approaches to reality with those of others, that the individual masters new approaches." VFT's activities involve children working together to create a digital play, design scenery, costumes, props, and create simulations in order to allow others to intervene and propose different solutions to the issue suggested by the play. These activities foster the coordination of approaches between realities, encouraging the children to master new approaches for problem resolution and solving conflicts.

Educational researchers, creative drama educators, and other educators have observed that learning happens best when there is emotional engagement with the theme. The research on brain development is trying to prove that bonding cognition and affect improves and facilitates learning (Johnson, 2004). James Gee¹ has hypothesized that video games and computer games in general explore this union between cognition and affect and therefore has a potential role in learning (see also Gee, 2004). Even though VFT is not a video or computer game per se, it fosters the tie between affect and cognition through creative drama and the virtual forum of dramatic actions.

In order to dramatize their scripts and exchange their point of views, the children will need to master the expression of emotions even when representing themselves by animated faces. The

¹ Key-note lecture and personal communication at CAL'05 Bristol – England 4-6 April 2005

theoretical framework of universal emotions, such as sadness, happiness, anger, surprise, disgust and fear provided by Ekman (1975) are the basis for the design of DF.

Research Questions

Our basic research question was to determine how well our current tools, namely DF and storyboard, support the kinds of interaction described above. While observing the children and taking notes from each session, we had these questions in mind:

- How engaging are the prototypes to the children?
- How do the children make sense of the tools?
- What do children learn by creating a digital play?
- How much of a collaborative learning environment is afforded by DF and storyboard?
- What should be the next steps in the design of VFT?

Experimental Design

We conducted all of the sessions at the Somerville Youth Community Center (SYCC), an endeavour that provides social activities and after school learning programs for local middle school and high school students. SYCC has a connection with its neighbouring public school, East Somerville School, and they were responsible to select the participants in partnership with the school. We follow the IRB protocol and each parent or guardian filled out and signed a consent form.

Our workshop entitled "Virtual Forum Theater" ran for three weeks, meeting twice a week for two hours each session. Alice Cavallo facilitated the sessions and was assisted by Michael Horn. We created pre- and post-workshop questionnaires for the children to answer. We videotaped all sessions using two stationary digital video cameras. In this way we recorded their interactions with the tool and among themselves as a way to document participant observation, their immediate reactions to problems raised by computer interactions, their engagement with the tool and the situation, and to collect data for later analysis. We coded

based on Spradley (1980) and on the “soft-nosed” positivistic approach from Miles & Huberman (1994).

The analysis plan was to generate notes from videotapes, compile the data from questionnaires and from our field-notes, then start coding and analyzing the data. The goal is to analyze the data in order to answer the research questions and evaluate the impact of the *DF's and GUI storyboard's prototypes*. We accomplished these goals by looking at children's attitudes, actions and reactions to the proposed activities, what they say about the activities and tools, how engaged they appear during the creative process and during the semi-structured work on the computer. We say that participants are engaged when they demonstrate a passionate feeling while performing an activity or task. For example, when a child shows signs of engagement, she might talk louder, use her entire body to gesture, look directly at the person or thing she's working with, and be harder to interrupt. On the other hand, when a child is not engaged, she may show signs of distraction or boredom, and her attention may wander easily. She may start doodling or get up and walk around the room.

Sampling and Data collection

The group consisted of eight school-age girls from the East Somerville School in Somerville, Massachusetts. Of ten students who were initially recruited, eight participated in the study. Four spoke Spanish as their first language, and two were native Portuguese speakers from Brazil. One was of Asian background and one from Scotland. With the exception of one child, all the others seemed to be from relatively poor backgrounds (lower-middle class). One girl was ten, four were eleven, and three were twelve years old.

Data consists of descriptive and observational notes taken after each workshop session as well as videotapes made during selected parts of the sessions.

Coding Strategies and Presentation of Data

First, we organized the notes from the sessions and from the videotapes into the descriptive matrix suggested by Spradley in *Participant Observation* (1980):

- Space: A computer room in a community centre. The room was dirty; the computers were not taken care of. Computer parts, such as mouse, speakers, mouse pad, loose cables, etc., were strewn on the floor. The computers were at least four years old and were running Windows 98. There were tables in the middle of the room. For us, it was not a good setting as we needed space for warm-ups. The room was big enough for the size of the group and for the warm-ups, as the PCs were located in a circle on the edges of the room. However, the big empty space in the middle was taken by the tables, which did not give us enough free space. We did not have the time to remove all the tables before every session.
- Actor: School-age children from East Somerville School.
- Object: Computers, tables, writing board (sometimes), digital cameras, video cameras, tripods, laptop, microphones, speakers.
- Act: Talk, brainstorm, participate in established activities, laugh, goof around, tease, draw, eat, and argue with facilitator.
- Event: A workshop on computer-created dramatic presentations.
- Time: Arriving and greetings, snack and chatting, warm-ups, working on the proposed activities: hand drawing, computer drawing, creating, brainstorming and typing script on Word, manipulating and creating digital faces, reading the script aloud, directing themselves in order to take pictures of the play, using the GUI storyboard module to add the pictures or faces and record the lines, using the free-software Audacity to record lines.
- Goal: Create a digital play to post on the web.

- Feeling: Some of the children were not willing to participate in the warm-ups. Two of the children had some problems focusing for long periods of time. They had a disruptive effect upon the group and could sense that we were not pleased with this. There were disappointments with the dramatic faces and with program glitches. There was excitement about creating the digital play, recording voices, taking pictures and manipulating both still and video cameras, and having a digital play with their pictures on the web.

Once this general organization was completed, we went over the data looking for semantic relationships (Spradley, 1980) as a way to better explain the cultural scene of our research group. Below are the isolated semantic relationships that illustrate the existing culture the facilitators carefully observed, identified and were confirmed by the video footage:

Included terms	Semantic relationship	Cover term
Disruptive Disrespectful	KIND OF	<i>Attitude</i>
Collaborative	"	"
Excited	"	"
Proud	"	"
Engaged	"	"
Argumentative	"	"
Curious	"	"
Childish	"	"
Mature	"	"
Close friends	KIND OF	<i>Relationship</i>
Becoming Friends	"	"
Indifferent	"	"
Superficially involved	"	"
Can we play the wood cutter game?		
Can we play the freezing game?	KIND OF	<i>Questions kids asked</i>
Can I draw on the board?	"	"
Can I draw the characters of my play on paper?	"	"
Can I use the video camera?	"	"
Can I use the camera?	"	"
Can I take pictures?	"	"
Can I record?	"	"
Can I substitute the sister in their play?	"	"
What is Virtual Stage?	"	"
What is an antagonist?	"	"
Can we synchronize the voices with the character's lips?	"	"
How can I make this mouth move slower?	"	"

How can I make this mouth smaller than this?	"	"
How many pictures should we take for a movement?	"	"
Is four scenes enough for a play?	"	"
Does the script sound like real life?	"	"
Do I have to worry about grammar?	"	"
Can we work together?	"	"
Can we use this microphone?	"	"
How do we erase a sound we have recorded?	"	"
How do we use the camera?	"	"
Talking to each other	IS A WAY	<i>kids teach each other</i>
Using the computer	"	"
Rehearsing	"	"
Being silly	IS A WAY	<i>to have fun</i>
Laughing at each other	"	"
Laughing at the mistakes of each other	"	"
Telling jokes	"	"
Exaggerating in their enactments	"	"

Table1. Semantic Relationship

These semantic relationships helped us to isolate some aspects of the children's culture, their relationships with each other and with the facilitators that might influence how they made sense of and engaged with the tools. The kind of attitudes the girls had was fundamental to how they tackled the problems presented by the activities and tools; for example, what they did and when they were deeply engaged with the tools or dramatic activities, or when they were being disruptive. At this point in our coding, we looked for patterns in the activities and meanings regarding to what the participants say in relation to their learning, to the division of tasks inside their groups, and to the level of difficulty of the activities. We addressed these goals using the schema suggested by Lofland (1971): Acts-Activities-Meanings-Relationship-Settings, and cited on page 61 at *Qualitative Data Analysis* (Miles & Huberman, 1994).

Below is a summary of the most relevant categories:

Activities	Sessions	Number of Participants
Eating snack and chatting (led by the children at the beginning of each session)	All	8 of 8
Warm-up exercises	All	7 of 8
Creating/ brainstorming a story to be presented as a play	First	8 of 8
Rehearsing the play through	Second	8 of 8

improvisations		
Talking as a whole group in circle	First	8 of 8
Drawing faces on the computer w/ Sodipodi (free-ware drawing tool)	Second	1 of 8
Drawing characters by hand	Third	1 of 8
Drawing faces on the computer w/ WebDwarf & drawing pad	Fourth	1 of 8
Writing script on Word	Second/Third	8 of 8
Rehearsing the play with the script in hand (lead by children)	Second/Third	8 of 8
Playing with Dramatic Faces interface	Second/Third	8 of 8
Playing with the Storyboard interface	Third/Fourth/Fifth	8 of 8
Creating Dramatic Faces	Second/Third/Fourth/Fifth	6 of 8
Working on the GUI Storyboard	Fourth/Fifth/Sixth/Seventh	8 of 8
Taking pictures of the play	Third/Fourth	8 of 8
Recording voices and animating w/ pictures using the storyboard interface	Fourth	4 of 8
Recording voices and animating w/ faces using the storyboard interface	Fifth	4 of 8
Recording voices with Audacity	Seventh	3 of 8
Revising and finishing putting together the digital play	Seventh	1 of 8

Table2. Activities

The girls had no problem manipulating the tools presented, except for the drawing tools (only one girl tried).
They took turns typing their script, making the animation, controlling the record buttons, and adding frames to sequence.
The division of tasks happened organically, while they worked in groups.
Even when each one was creating her own character's face, another one would watch and give some comment or feedback.
They did not find it difficult at all to use the available VFT tools, but they were disappointed because the tools were not working well and they lost time with them.
The children did not get a good idea of what a Virtual Stage was. We gave an explanation when students asked about it during the time when they were filling out the post-workshop questionnaire.

Table3. Meaning

Students knew each other for the most part because they attended the same school.
There were a couple of very good friends; at least three pairs were very close to each other.
Two pairs embraced a third girl.
The youngest girl (who was ten years old) had a difficult time focusing for too long and her best friend followed her example. The two of them, after a while, were not as welcomed in the group because they were being disruptive.
There was a lot of laughing going around, but there was no indication that they were being mean to each other.
They did make some fun of each other, but it was all accepted and well received by them.
The younger girl and her best friend argued with us from the 3 rd session on and took as much of our attention as they could.
The girls shared one computer without any problem, except for Polly and Sara.
They all want to use the digital still camera and the video camera.

Presentation and analysis of findings



Figure 3. Creating Dramatic Faces

Group Dynamics

Even though our plan was to have the group produce only one play, the children preferred to form two groups to work on two separate plays. Group A consisted of Sara, Polly, Carla, and Kelly. Group B consisted of Ilana, Elvira, Natascha, and Leila. These are not the real names of the subjects; they are used here only to facilitate discussion while preserving anonymity.

Sara, the younger girl, and Polly, her best friend, were well engaged in the warm-ups, making up stories and enacting them. They were somewhat restless, but because we gave a lot of freedom on these activities, they would stick with them. They also had enough interest to write parts of the script, taking turns with Microsoft Word. However we noticed on the tapes that they would not do this for more than fifteen minutes at a time. They would write for some time, and then walk away from the computer, go outside the room and talk with someone, or go to see what the other group was writing. It became more difficult to engage them in the other computer tools we provided. The other tools required more time and focus because the children had to record each line of each character separately, and add pictures or dramatic faces to each line. Together with their group they took pictures of their play (4th

session), but the group had to stop shooting because Sara and Polly would not participate in the activity any longer.

From that fourth session onward, other girls of the group did not think that they could count upon Sara and Polly. Sara got very upset, saying that the group was blaming her. When they sat together during the fifth session to use the GUI storyboard, they recorded the whole play at once, by taking turns with the microphone and without realizing that one sound file could not take more than sixty seconds of recording.

Sara became increasingly uncooperative with one of the facilitators by the third session. Carla got involved with the other group and helped them to create the digital play. Kelly also worked with the other group for most of session five, when Carla came late and Sara and Polly were not participating. Group A did not manage to complete their digital play.

Group B was more interested in the project as a whole. Ilana, Elvira and Natascha were eleven years old but certainly had more maturity than Polly (see discussion on developmental stages). This group took pictures of two scenes of their play, but unfortunately they had the script in their hands at the time, so that a sheet of paper appeared in each photo. Leila and Natascha put together one scene of the play using the pictures, but nobody was happy with the quality of the pictures. We did not intervene in their process of taking pictures. We would comment that they did not need to read the script aloud because the sound was not being recorded. But they insisted on it. It felt like they were concentrating on rehearsing the play, which was a familiar activity. They directed each other in terms of intonation, body position, movements and staging. It was an effective learning process where they were in charge.

They had a difficult time taking the pictures in a detailed sequence because the shutter on the digital camera reacts slowly to being pressed, so that they would have to back up their movements in order to capture them all. The process is very time consuming and they did not get bored with it, but they felt it took too long. Some of them wanted to re-take the pictures, but it was not a unanimous decision. Each member of this group created about five dramatic faces, which they used for creating their play with animated faces and recorded voices.

The group was so committed to finishing their digital play that they asked us to come one extra day. As the storyboard's bug could not be fixed in a short period of time, we introduced them to the software program Audacity to record the character lines. Ilana, Elvira and Natasha had no difficulty using Audacity. They recorded line-by-line, as well as the entire scene.

Children's Dramatic Productions

During our first session, we asked participants to create a plot for their play. Both groups started to create fairytales, but we reminded them that we would prefer real life situations with struggles that could lead to different ways of problem solving. With our suggestion in mind, Group A created a script portraying four girls who got into a discussion and acted mean to each other. In the script, the four girls were playing hide and seek when two of the girls got lost in the woods and the others thought they were cheating. The response of the two other girls was drastic, including revenge with extreme consequences.

Sara and Polly took their rehearsing process well, while Claudia and Kelly sometimes did not engage with it. Even though it could have been a real story, it sounded a bit unrealistic, and reflected the desires and developmental outlooks of Sara and Polly who led the creation process. Polly and Sara were not concerned with social issues yet. Their interest was around fantasy like stories and this was the main reason why Claudia and Kelly, who were older, did

not connect so much on their script and identified themselves with the problematic portrayed by Group B.

Group B wrote a script about two sisters struggling to relate to each other: a girl around ten years old and her teen sister who did not want to talk to and support her. This felt like a real and familiar story to all the girls in the workshop. We noticed that for most of the girls in this group there seemed to be a kind of shyness in portraying the real emotions and proper voice intonation for their characters. The situation was too close to the students' realities and we deduced that they might have been ashamed of screaming and being rude to each other in front of all of us. We believe this was one of the reasons why they were laughing at each other during the time they were taking the pictures, because it might have been difficult to portray themselves in a private situation. To solve this issue, we could have done more dramatic exercises to build character, which means this kind of activity needs to happen at least throughout one semester; doing drama with this age group requires more time on character development before the digital play can be created. The analysis of the children's scripts is a rich area for study, but it goes beyond the scope of this field study.



Figure 4. Group B's scene rehearsal

Developmental Stages

We observed differences in the children's developmental outlooks as being part of a continuum. Sara and Polly demonstrated an egocentric point of view and did better working

alone rather than collaborating with their group. We can find evidence for varying perspectives in moral relations, from egocentric to cooperative, in Piaget's book, *The Moral Judgment of the Child* (1932).

Keagan (1995) explains logical-cognitive domain, social-cognitive domain and intrapersonal-affective domain based on Piaget and others through the Three Principles of Meaning Organization. The Second Principle applies roughly between the age of six and teenage years, while the Third Principle encompasses teenage years and beyond. At the social-cognitive domain of third principle, children are aware of shared feelings, agreements and expectations that take primacy over individual interests. Learning through Drama could support enhancement of the intrapersonal-affective domain at the Second Principle, when the child can not internally coordinate more than one point of view, or distinguish one's needs from oneself. On the other hand, the child at the Third Principle, by internalizing another's point of view, co-constructs personal experience and creates a new capacity for empathy. At the Third Principle, she can coordinate more than one point of view internally, thus creating emotions experienced as internal subjective states rather than merely social transactions. VFT aims to work on the level of enabling internalization of another point of view through simulations of ambivalent scenarios.

According to Keagan (1995), these principles inform how one constructs experience generally and organizes the form of one's thinking, feeling and social-relating but not its content. Understanding that a child is in the stance of the Second Principle advises us about "how" she thinks or feels but not about "what" she thinks or feels. When a child transitions from the Second Principle, for example, she controls impulses, she reflects on appearance and distinguishes it from reality.

By examining the social-cognitive domain, we can understand why at least two of the girls, Sara and Polly, were not quite ready to share computers or attention with the other participants. Sara seemed to be navigating at the Second Principle level. Polly was perhaps between Second and Third Principle levels but by peer influence, she behaved in the same order of development as her best friend. Sara manipulated others on behalf of her own goals. When recounting her group play, she was not able to articulate it clearly, omitting facts that were only in her mind and presuming that others shared her thoughts. She also had a difficult time creating a story dealing with issues of daily life (transition from fantasy to reality). Our observations match the “Three Principles of Meaning Organization” developed by Keagan (1995) regarding what to expect of this age group. We do not intend to probe stages with these reflections but to understand the different ways these children relate to each other and engage with the activities due to their developmental differences. These observations emphasize that working through drama and technology might directly affect the social-cognitive and the intrapersonal-affective domains of development; this is a topic for future research.

Pre-workshop Survey	7 out of 8 replied
Experience with personal computers	Above Avg.: 3 Average : 3 Below Avg.: 1
Hours using computer per day	One hour: 3 two to three hours: 2
Uses computer for	Homework : 7 Fun: 2
Have you done theater in school?	Yes : 4 No: 3
Have you done theater outside school?	No: 7
Aware of issues on your community	Above Avg.: 5 Average: 2 Below Avg.
Know how to solve communities’ issues	Above Avg.: 3 Average: 1 Below Avg.: 3
Post Workshop Survey	5 out of 8 replied
Have you gained more computer experience?	Above Avg.: 3 Average: 1 Below Avg.: 1
Have you learned anything new about drama?	Above Avg.: 3 Average: 1 Below Avg.: 1
How much have you learned about creating a play?	Above Avg.: 5 Average Below Avg.
Have you learned new insights about working collaboratively?	Above Avg.: 3 Average: 2 Below Avg.
Does it make sense to create a digital play?	Yes: 5
Why?	More people can see it and you don’t have people watching you while you do it. You learn more computer stuff and even new words. It has become

	easier, enjoyable and fun
Does it make sense to perform a play on a virtual stage?	Yes: 5
Why?	It is available to people all over the world. You understand it It's fun, interesting and like real life.
How is it different from putting a play together and performing on a real stage?	Way different, you get help or more people. Putting the play together is different. It's different because both are different. It's different because you don't have to do everything all at once and you don't have to get everything right.
Have you felt any difference in your communication skills?	Yes, I felt some happiness. Maybe because I had fun and talked to people more here. Yes because I don't feel that nervous to talk to people. Don't know.
What difficulties did you have with the tool?	Nothing really. The black computer didn't work. The computer wouldn't record our voices. I have never had experience doing the play in computer.
Was it an enjoyable experience?	Yes, I had fun, we played games and everything. Yes because Ilana and Elvira were here, we laughed a lot and played games. Yes because we had fun, played games and I had someone to talk to. Yes, it was a fun experience with a lot of friends.

Table 5. Results of the pre- and post-workshop questionnaires

Discussion

From the dramatic arts point of view we learned that the workshop we had proposed must be longer. In order to work on both live and virtual dramatic skills this work has to go for at least four months with two or three sessions per week. We need to work on character building and techniques to get in character. The main problem we noticed in these three weeks was that the girls were constantly giggling when they had to get in character. They could not concentrate on their characters without exercises and techniques. This inability to get into character made it difficult for them to take the pictures of their enactment and to record the voices in a proper way. We knew what was going on, but we did not have enough time to take them away from the computer and work on techniques. We also did not have an adequate space.

This age group also needs some time to adapt to the activity, including relaxing, loosening up, and engaging in warm-ups and theater games. They are shy about participating in these games at first. Most of them were willing to work on the computer, but in reality they were not ready to get into characters in a “cold” fashion, as we call in theater terms.

Dramatic Faces turned out to be too simple for the girls. The first reaction was that the face was bald. Then we created two other faces with hair. They had then three characters to choose from, but that was not enough. After the second session, we easily learned that the DF needs to offer a variety of personas and it might have a better effect if it is two dimensional.

The children also had some problem in dragging the lips of the face. The motions of the lip were not smooth and they could not easily get the lips on the desired position. At each slight movement of the mouse, the lip’s contour would move farther than the mouse. That was disappointing to the children and contributed to their unwillingness to use the faces. The GUI storyboard presented a sound recording problem and also ran slowly on the Windows 98 machines. The group from Ilana, Elvira, Natasha and Leila used it on the fourth session to create one scene with the pictures taken during previous session; we found out then that the sequences were not working properly and the sound recording was only working for the first sequence. We repaired that bug and during the following session, we noticed that the interface was running extremely slow and presenting an “out of memory” error, the audio file was bigger than it supposed to be. They spent about four hours manipulating the storyboard and about an hour creating emotions and expressions with the faces. Even with the disappointments regarding DF, they were engaged with the process of creating a digital play and the tools were easy to manipulate and figure out. The idea of VFT is proved to be

appealing and a better tool would afford an effective learning and more satisfaction for the children.

We had a strategy of starting the session with the tool already loaded and initiated on the computers which turned out to be a good one. The children started playing with the tool by themselves, discovered how to manipulate it on their own and got excited about using it. We did not need to give many explanations at all regarding the use of the tools. They had questions about how to manipulate the mouth in terms of tweaking, and how to erase a voice they had just recorded. These were the only doubts generated by the tools which turned out to be the glitches they have at that stage.

The discussion above is a reflection on how engaging the prototypes are to the children and how they make sense of the tools; it gives some answers to our first research question. These results of the participants' interaction with DF and the GUI storyboard gave us very good guidelines for future work.

The afforded learning

There was no time for end of session reflections, which made it harder to access well the learning that was going on. Reflections usually generate the verbal production of the participants. We do not have much data that falls into the "meaning" category in order to analyze the learning afforded by the tools, especially because the videotapes did not capture well the conversations between the children. Although, through analysis of the participants' behaviours (videotape), the questions they asked and the questionnaires' answers, we concluded that:

- they felt confident to be able to manipulate VFT's standalone modules and Audacity (a free-software for recording audio) without any difficulty

- they got a better understanding of smaller amounts of time during a dramatic presentation
- they learned the importance of emotions for a dramatic play
- they learned how to manipulate a digital camera
- they learned about the animation process through frames
- they practiced directing, staging and lighting
- they exercised team work, collaborative creation and expressive fluency

Observing the way they manipulated the prototypes (DF and GUI storyboard) and the tool, Audacity, it was clear that they felt comfortable with them. They had very few questions about how to manipulate them. They all answered the post-survey classifying them as easy to use and some replied that they had learned more about computers. These data are an indication that, by learning how to use new computer tools, the girls come to feel more confident about themselves.

The group of Ilana, Elvira, Natascha and Leila were reading aloud each character's line and timing them. Then they would enter that time in the storyboard interface and add one or two extra faces to the sequence. For example, if character A speaks for 7 seconds then they add 8 to 9 faces to animate that sequence. The animation is created for each act of the play by creating one sequence for each character speech, or if the speech is longer than 10 seconds, they split it in two parts. The reason for this split is that one sequence can take only 10 frames, and if one records a line of more than 10 seconds with only 10 images, the animation will play slow. The ideal timing between frames is .85 seconds and 1 second per frame would be the maximum tolerated by our animation.

The goal of VFT is to have a virtual play that runs like a movie in order to capture well the expressions, movements and emotions of the characters. The first time they put one act together they did not time the first few lines and realized that the speeches were being cut by the application. By the second time they were using the tool, they did a great job in timing the

speeches, saying to each other: “you are reading aloud too fast and that is not the way the character would speak.” They learned that the speech “yeah right” takes less than one second; therefore, they improved their conception of small amount of time. They become aware of how long each speech and the play would take.

The DF interface afforded collaborative learning through discussion and reflection about characters’ expressions and emotions. The girls were thinking about and discussing what would be the expression of a character during the moment she is delivering her line. They came to the conclusion that at some moments there was not any special emotion, but they wanted to portray the lips moving as the character was talking. They required a sophisticated synchronization between voice intonation and lips movement. They also figured out that they could not giggle while taking pictures of their enactment or recording the play, or else the expressions, emotions and voice intonations would not be appropriate.

None of the participants had manipulated a digital camera before; they were all excited and eager to learn. Learning to use the camera was an easy step, but making the animation happen by taking two or three pictures of each movement was difficult and a time consuming task. They also had to think about light and background before taking the pictures. Coordinating movements with the camera angle and keeping the camera still was another learning process that they did not have time to improve. They were exposed to these constraints and had to work with them, but they did not have enough time to master them all. During the process of taking the pictures of two scenes, they had to organize themselves, to make sure the characters had the right position in the scene, the appropriate expression and voice intonation. Voice intonation was not important for the activity of taking pictures of still images, but the use of language during rehearsal time is a natural process of behavior. One needs to go

through a series of dramatic games in order to practice expressing emotion without the verbal language.

The children learned that in order to take pictures of the whole play, they need to organize the settings and create the scenario (background and props) that suits the script, they need to repeat the movements methodically and they do not need to give the lines while they are taking the pictures. They concluded that it is different to put together a play to be enacted on a stage from a digital play, as some of them replied to the survey “you don’t have to do everything all at once and you don’t have to get everything right.” The conclusions that they came up when answering the questions of whether it makes sense to create a digital play or why it is different from a regular play were completely their own. We made no comment about it during the sessions. Quotes like “more people can see it and you don’t have people watching you while you do it,” or “it has become easier, enjoyable and fun” shows that some children who have a certain fear of presenting themselves on a stage love the idea of digital plays and that they also feel excited that more people can have access to them. An indication that VFT might improve computer skills in children can be found in the quote: “you learn more computer stuff and even new words.”

The lessons learned mostly address the third and fourth research questions. We acknowledge that even though we have few answers, they are enough to suggest necessary improvements.

Conclusion and Future work

We have learned from the children’s interaction with the standalone interfaces that DF needs to be improved regarding smoother movements to the mouth and eye. Ideally it should have two dimensions and colors, and the synchronization of voice intonations and lips should be implemented. We noticed that the storyboard can be improved by displaying the shape of a wave sound with the time in seconds where the frames are to be inserted to create a sequence.

We will increase the number of frames allowed for one sequence to 30 images. We realize that the storyboard should run a bit faster which means redesigning its architecture.

We found signs of cooperative learning in group B, but this workshop was too short to show improvement in critical awareness, expressive fluency, and conflict resolution skills. Based upon existing research on drama in education (Heathcote, 1984), on cognitive developmental theory (Keagan, 1995) and within internet multi-players games (Gee, 2004, Gee, 2003) , we believe that the work of creative drama, character building, internet-based simulations of dramatic conflicts, face-to-face and virtual interactions can support the development of social-cognitive and intrapersonal-affective domains on children.

Providing a longer time to work with a revised and enhanced version of VFT in a nurturing environment might be the solution for bridging developmental gaps and engaging learners at differing levels in playwriting and playmaking. As soon as we have an improved and on-line version of VFT, we plan to repeat this study with some new questions that arose during this work: What can one do to bridge developmental gaps? What can one put into the VFT to engage learners at differing social-cognitive outlooks? What structure for collaborative playwriting and playmaking can provide a deeper engagement?

Several evaluations of out-of-school programs performed by institutions like *Massachusetts 2020* (n.d.), *Afterschool Alliance* (n.d.), and *National Institute on Out- of- School Time* (2003) among others are proving the importance of unstructured afterschool enrichment activities. Studies show that especially now, when Massachusetts public education is driven towards MCAS, extra-curricular activities are important to augment limited classroom time and help students to perform better in schools. VFT would be perhaps best applied by creating an afterschool program for at least six months, running every day of the week for two hours.

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