"Voulez-Vous Jouer?" [Do you want to play?]:

Game Development and Play for Enhancing Literacy

By

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ABSTRACT

This study investigated the use of advanced gaming environments in developing literacy in French. Two environments were used in this study – a web-based game shell, and an advanced videoconferencing environment ENJEUX-S. Two grade 6 classes were observed while they engaged in game development and play. In each class students were creating games on the topic of their interest in groups of 2 or 3. As a culminating activity, students in one class played against each other using the videoconferencing environment. The findings suggest that advanced gaming environments can serve as successful vehicles for developing French-language skills, fostering traditional literacies, and developing new digital literacies. The study demonstrated that flexible non-linear pedagogies of technologies allow teachers to use computers in the classroom effectively.

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I. Introduction

Contemporary notions of literacy now extend beyond traditional print formats, and a rethinking of the kinds of literacy skills that will be required for full social and economic participation in the 21st century is well under way. Yet schools for the most part still view literacy from a traditional perspective (Castells, 2000; Tyner, 1998). Outside of school the new generation of learners, frequently referred to as 'digital natives' (Prensky, 2006), are regularly immersed in a wide variety of new electronic media and as a consequence are developing knowledge and skills that increasingly diverge from those that are valued in school (Lankshear & Knobel, 2006). In light of these dramatic changes and because of the failure of schools to respond, prominent educational and media researchers are calling for the revision of traditional pen-and-paper curricula to include multiple media for the representation, production, and dissemination of knowledge (New London Group, 1996; Cope & Kalantzis, 2000; Kress, 2003). Advocates of this perspective contend that schools must be the primary agents of change that take the lead in revising the old curricula and providing students with opportunities to extend their repertoire of literacies to better prepare them to be competitive and responsible citizens in the new millennium (Kellner, 2004). A recent report by the government-appointed Ontario Expert Panel on Literacy, for example, acknowledges that education needs to take into account the changes in literacy requirements, and present students with a range of texts that move beyond print to incorporate multi- and hypermedia (Ontario Ministry of Education, 2004). The Federation of American Scientists' Summit on Educational Games concludes that "educational institutions need to transform their organizational systems and instructional practices to take greater advantage of new technology, including educational games" (Federation of American Scientists [FAS], 2006, p. 46).

Among the many media artefacts of the digital era computer and console games stand out as examples of a tremendously popular and successful media. According to Rideout, Roberts, and Foehr (2005), "more than eight in ten (83%) young people have a video game console at home, and a majority (56%) have two or more" (p. 36). Video and online game production is a multi-billion dollar industry whose profits reached 7.4 billion dollars in 2006 (Entertainment Software Association, 2007). Indeed, computer gaming is more frequently chosen by young people as a recreational activity than watching television (Squire, Giovanetto, Devane, & Durga, 2005). By the time an average American turns 21, he or she will have spent 10,000 hours playing computer games (Prensky, 2006).

Computer games, being a popular and familiar medium to most young learners, present an attractive and efficient means to bring new forms of contemporary digital literacies into the curriculum. Educational theorists argue that gaming embodies a new kind of literacy (Gee, 2003; Squire et al., 2005), one that combines significant elements of traditional reading and

writing with new literacies that pertain to accessing and evaluating information, constructing complex narratives, decision-making, and navigating rich multimedia environments (Lotherington, 2004; Beavis, 2002). In addition, massively multiplayer online games such as *World of Warcraft* are seen as a potentially powerful vehicle for developing the new set of digital literacies required to navigate the digital world (Steinkuehler, 2008). Playing and (especially) developing online games can allow students to access and engage with digital media and explore them, both independently and cooperatively. This exploration fosters the emergence and development of digital metaliteracies—skills which include navigating and 'reading' digital environments, as well as developing an understanding of the digitally-connected audience, and searching for information online (Lotherington, 2004). Squire (2008) argues that games develop a new kind of literacy:

> Game-based literacies include a constellation of literacy practices that are quite different [from school literacies]: texts are spaces to inhabit, learning as a productive, performative act, knowledge is legitimized through its ability to function in the world, participation requires producing as well as consuming media, expertise means leveraging digital spaces to further one's goals, and social systems have permeable boundaries with overlapping trajectories of participation (pp. 662-663).

The growing gap between the increasing sophistication and attractiveness of commercial gaming and the relatively static practices of school-based learning have led scholars to challenge the current state of technology use in schools. Squire and colleagues, for example, ask "How will educational technologies respond to a generation of students who, raised on interactive games, expect the same kind of interactive experiences from their educational media?" (Squire et al., 2005, p. 34).

To address the need to develop both traditional and the newer, digital forms of literacy in students within a school setting, and to more fully engage students through interactive learning experiences, we conducted an experimental study to examine the effects of student online computer game development and play on literacy skill acquisition. Students researched and developed curriculum-based questions which they then incorporated into electronic versions of popular board games. Once students completed their games, they played them against their classmates using an advanced gaming environment incorporating videoconferencing.

Games and learning

The strong, widespread appeal of computer and console gaming to today's students has motivated a number of researchers to look for meaningful ways to understand the principles behind learning through games, so as to better harness the educational potential of gaming (de Castell & Jenson, 2003). Some argue that successful recreational games employ many principles of effective learning (FAS, 2006; Gee, 2003; Mitchell & Savill-Smith, 2004;

Prensky, 2006). Games create opportunities for situated learning by providing immersive and motivating contexts for players to engage in a wide variety of activities and to develop and practice the skills necessary to be successful in those activities (Gee, 2003; Shaffer, Squire, Halverson, & Gee, 2005). A number of attributes common to computer games are recognized as critical in fostering active engagement, motivation, and high levels of persistence in game play (see Garris, Ahlers, & Driskell, 2002 for a more complete review). These include the use of high resolution media to create immersive environments and simulate quasi-realistic sensory experiences for the players (Mitchell & Savill-Smith, 2004); providing opportunities for identity exploration and play through the inclusion of fantasy, narrative, and role-playing (Gee, 2003; Squire et al., 2003); and creating a sense of pride and accomplishment through structuring the game play in complex ways that will challenge the player at the "edge of their region of competence" and allow for progress through trial-and-error experimentation (Gee, 2003). Successful games support players through creating scaffolds, or built-in cues, hints, and practical solutions to keep them immersed in the game (FAS, 2006). The motivational power of the best games keeps players involved in them for many hours, and their game play designs allow players to experience flow—a state of optimal engagement characterized by a deep immersion into an activity, accompanied by heightened concentration, motivation, and sense of fulfillment (Csikszentmihalyi, 1991; Inal & Cagiltay, 2007). Researchers have noted that the social aspect of collaborative or competitive game play fosters learning through team-playing (Mitchell & Savill-Smith, 2004) and group problem-solving (Kiili, 2007), and offers opportunities for players to cooperate not only within the game, but also within the larger community of the game's fans through websites and online forums (Shaffer et al., 2005).

If computer games are to find their way into regular schooling and be supported by the broader educational community, systematic and multi-faceted research on their effectiveness needs to be undertaken (FAS, 2006). To date, there is insufficient research beyond anecdotal evidence that would support game use in the classroom (Bonk & Dennen, 2004; Dempsey, Haynes, Lucassen, & Casey, 2002; Gredler, 2004). A series of early experimental studies looked at the impact of specific game and simulation attributes on student motivation, learning performance, and perceived self-efficacy (Cordova & Lepper, 1996; Parker & Lepper, 1992). These studies identified four key factors that contributed to increasing student motivation and engagement in learning: the provision of a narrative context for the game; the incorporation of fantasy elements in a game; the inclusion of opportunities for players to make choices during game play; and the provision of opportunities for the incidental personalization of the game activity by the player.

More recently, several qualitative case studies investigated the educational potential of gaming. McFarlane, Sparrowhawk, and Heald (2002) conducted an evaluation of educationally relevant commercial and 'edutainment' games in 12 elementary schools. They

found that while playing these games students engaged in deductive reasoning, collaborative problem-solving, cooperative learning, and peer-tutoring. Teachers in the study saw several educational benefits to the use of the games, including developing students' communicative, collaborative, and strategic-planning skills. In a similar study six different games were deployed in 11 secondary schools in Britain (Becta, 2001). The study reported that gaming promoted learning very effectively through combining high interactivity with an appealing and novel narrative context. Additionally, student motivation, collaboration, and task persistence were high, and there was evidence of social construction of knowledge.

Games, engagement, and literacy

Collectively, the initial research findings on educational gaming suggest that it has a place in classroom instruction, and can be used to facilitate learning in multiple ways. Perhaps most importantly, it can be a vehicle for increasing motivation and engagement. Student engagement is a crucial element in academic achievement, and especially so in relation to reading and literacy (Learning Point Associates, 2005). Studies have shown that academic achievement is associated with engagement in reading and classroom-related activities (Finn & Rock, 1997). With regard to students-at-risk, high engagement in reading results in better reading scores for students of lower socio-economic status compared with less engaged students of higher status (Kirsch et al., 2002). Since entertainment games appear to be an extremely successful means of motivating and engaging youth, it seems reasonable to contend that given properly designed educational gaming media, much of this motivating power could be harnessed in formal literacy instruction. Game use in the classroom could provide or develop many of the components and factors that research has found to be related to literacy development: the provision to students of relevant and interesting material (Greenleaf, Jimenez, & Roller, 2002); the heightening of student self-confidence and control of their own actions (which students so often lack at school) (Alvermann, 2003); and greater student involvement in reading (Baker & Wigfield, 1999) and collaboration (Guthrie et al., 2007). Some initial evidence for this contention can be found in a recent study investigating the instructional use of gaming showed which students playing games experience flow, are immersed in learning, and have increased time-on-task which leads to better learning (Inal & Cagiltay, 2007).

The research on the effects of computer game development—as opposed to game play—as a pedagogical activity is scarce. Initial evidence suggests that giving students opportunities to input their own content into a game can be a powerful motivational tool that contributes to a sense of pride and accomplishment, and facilitates learning (Gee, 2003). The primary roadblock to utilizing game design for learning in a school context is the lack of expertise on the part of students and teachers who do not possess the complex skills required to create computer games. A solution to this problem lies in using a web-based game shell such as the one employed in the present study. Game shells do not require any sophisticated hardware or

software, and developers do not need to perform complex programming tasks in order to create games using these shells.

The game shell used in this study effectively combines elements of familiar board games with the interactivity and appeal of contemporary online games. Board games have been recognized as tools for early literacy development (Saracho, 2000, 2002). Researchers argue that forming a positive attitude towards reading and literacy through playful and entertaining activities, such as board-game playing, helps develop avid readers (Sonnenschein, Baker, Serpell, & Schmidt, 2000). Board games have been used successfully in primary school research for fostering group learning and collaboration in literacy skills development (Lyle, 1999). Lyle (2000) found that student literacy skills were enhanced by teaching geography using a range of literacy-specific activities including creating a board game. She argues that writing game instructions and creating game cards fosters development of writing skills and engenders student enthusiasm. In a project focused on literacy development in an after-school playground that combined electronic and board games, Blanton, Green, and Cole (1999) found that playing board games is associated with developing literacy and essential learning skills, including language comprehension, social skills required for collaborative learning, and task persistence.

In order to foster literacy skills, the game development activities selected for this study had a strong language component. Students developed web-based board games by inputting series of question into game shells. We hypothesized that creating game questions would be a literacy-rich task that would allow students to engage in reading, writing, and speaking in the language of instruction – French, while staying engaged in a motivating gaming activity. There is ample evidence that questioning as an instructional activity increases students' comprehension and literacy skill (Rosenshine, Meister, & Chapman, 1996). Wong (1985) discusses the instructional merits of using student-generated questions in reading, which include active processing of the material, activation of prior knowledge, and improving students' metacognitive skills. Lubliner (2004) found that individual instruction of struggling fifth grade students in generating questions resulted in improved reading comprehension. Additionally, King (1994) reports that using a collaborative questioning strategy improved student comprehension for grade four and five students who generated and answered their own and each other's questions.

Research questions
In summary, there is considerable theoretical and research support for using game play to increase student engagement in school activities, their task persistence, motivation to learn, collaboration, and foster the development of traditional and new digital literacies. Game development and play then serve to mediate improved achievement, as well as promote the development of social learning strategies. In this study, we examined the impact of student

development of computer games in French language settings. The questions that guide this research project are as follows: (1) How does intensive game development impact students' literacy skills, both traditional and digital? (2) What are the benefits of game development and play for providing an authentic immersion into French language? (3) What individual and social learning strategies do students employ when using the advanced learning environments? How and to what extent do they cooperate, collaborate, or compete? (4) What pedagogies of game environment use have the teachers developed? What constitutes an effective literacy pedagogy of technology?

II. Method

Research design

We conducted the study in two classrooms of two public schools in Ontario. One class was a 5-6 grade split in a French first language school which will be referred to as Class A in this report. The second class, referred to as Class B, was a grade 6 French immersion class. Upon identifying the teachers, we invited them for a one-day workshop in which they were introduced to the Educational Game Central (EGC) game shell, and to the ENJEUX-S advanced gaming videoconferencing environment.

The project had two main phases. In phase one, students in the two classrooms used the EGC game shells to develop games. First, the teachers in each classroom presented the game shells to the students, and had their students play in teams a game about revision that the teachers had created. After the students were introduced to the game environment, they were divided into groups of 2 or 3. The groups then selected a topic of interest to them, a game type, and created a set of questions on that topic. Students created *Tic Tac Toe, Snakes and Ladders, and Trivia* games as those were familiar to the students, and required a manageable number of questions. Students in class A then did research at home, and filled out a worksheet with all their questions and the answer choices. The groups then took turns to go on the computer stations and enter their questions into the game shells. Students in class B did their research in class while using the computers, and did question composition and game creation simultaneously. Table 1 summarizes the topic selection and the game type for each group.

Class	A (5-6 split)	B (6)
Game selection	Le baseball (SAL)	Star Wars Trivia (Trivia)
	Le Système digestif (SAL)	Sports (SAL)
	Les avions (SAL)	Math (TTT)
	Les chiens (SAL)	Folle de Trivia (Math Trivia)
	Notre belle galaxie (SAL)	Colors (TTT)
	Les étoiles (TTT)	Sports (SAL)
	Les Sports professionnels (TTT)	Trivia de films (Trivia)
	Planche à rama (SAL)	Films (Mother Goose)
	Le Tigre, un mammifère impecable	Couleurs (SAL)
		St. Valentine's (TTT)
		Quelle Repas??? (Mother Goose)
		Memoire des sports (Concentration)

Table 1. Game topic and type by student groups

In phase two, students engaged in competitive game play using the ENJEUX-S advanced gaming environment. Since the teacher from class B could not continue to participate at this stage of the study, the students in class A were engaged in play against their classmates. Two classrooms were set up with a computer with a wireless access, a webcam, and a microphone. Two groups of students took turns to play against another team in the classroom, selecting a game that has been created by a third group to avoid unfair advantage.

Game shell

Education Games Central (http:// egc.savie.ca/) was the game shell used in the study. This web-based shell simplifies the construction of electronic versions of popular board games. To create a game, students need only develop a set of questions and answers and enter them into online forms. Each game requires a different minimum number of questions for the game to function properly: *Tic Tac Toe* needs 16 questions; *Snakes and Ladders* needs 27 questions; *Mother Goose* needs 44 questions, and *Trivia* needs 54 questions. Game developers have the option of specifying the feedback a player receives when a question is correctly or incorrectly answered. They can also embed links to web resources in the questions. A step-by-step wizard-like guide down the left side of the game creation page verifies whether all questions are entered correctly and if the game is ready to play. Figure 1 illustrates a question creation page. When playing the game, players are presented with a question from the game which they must answer correctly before advancing on the game board. The game shell was originally created in Quebec, Canada, and its operational language is French. It was later translated into English and Spanish. For the purposes of this study the original French-based game shell was used. Figure 2 shows a *Tic Tac Toe* game developed by a student in this study.

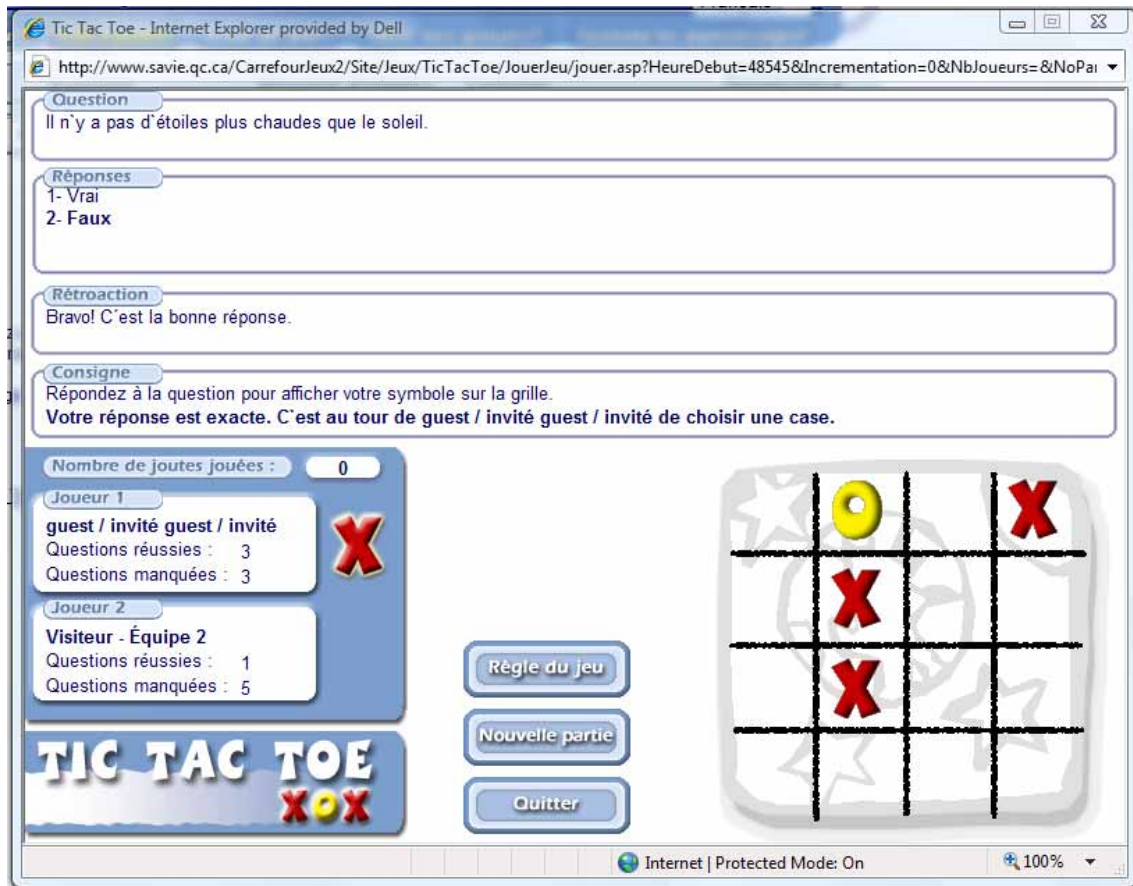*Figure 1.* EGC Game Design: Creating questions

Figure 2. ECG Game environment: Tic Tac Toe

ENJEUX-S environment

The advanced gaming environment—called ENJEUX-S—allows players to participate in the EGC game play (as above), but in multiplayer, three-dimensional mode supported by built-in video conferencing (see http://www.savie.qc.ca/enjeux/). The players log into the environment with their unique ids, and set up a meeting or join an existing meeting. Once the players join the meeting, they can engage in a variety of activities, one of the principal ones is game playing. Figure 3 presents a screen shot of the waiting room to which the players are introduced upon logging in.

The features of this environment include a video and audio conferencing, a live chat, as well as an interactive environment in which the games can be played in real time. Figure 4 presents a screenshot of the advanced gaming environment with a game play in progress. The participant who initiates a meeting is assigned the role of the administrator who can add activities and invite other users from the list of registered participants. In this study, the administrative functions were performed by the teacher and the research team.
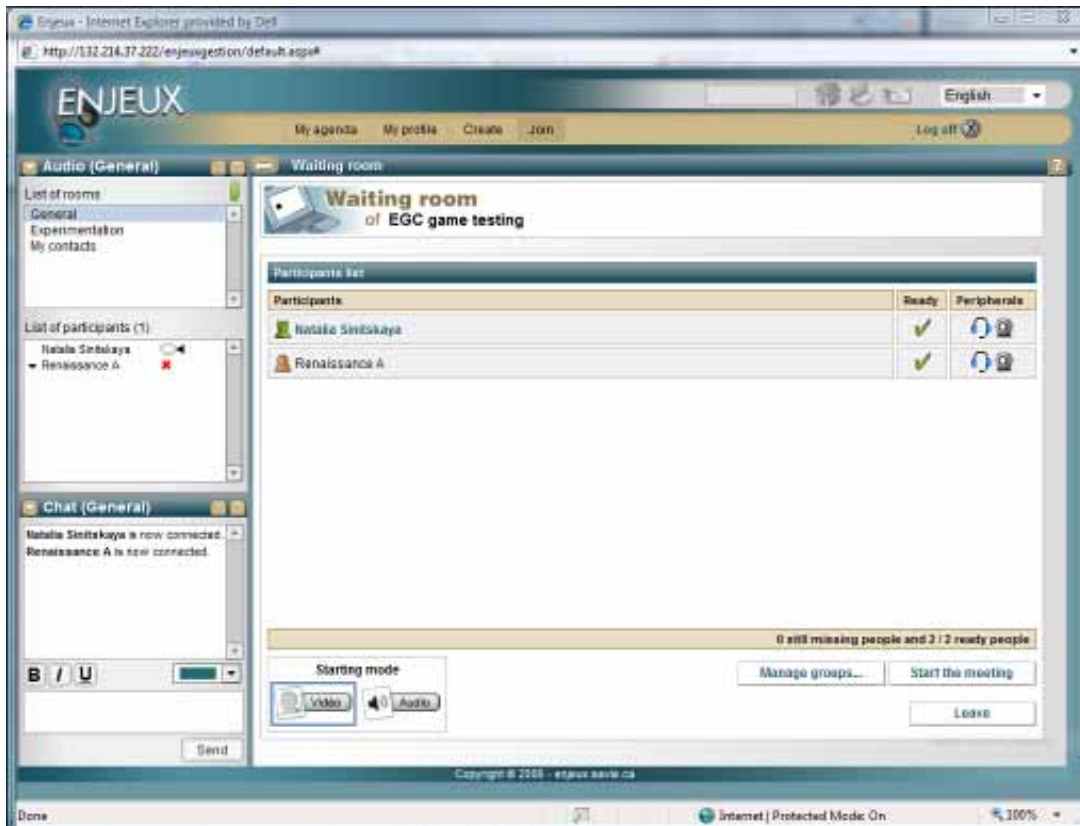
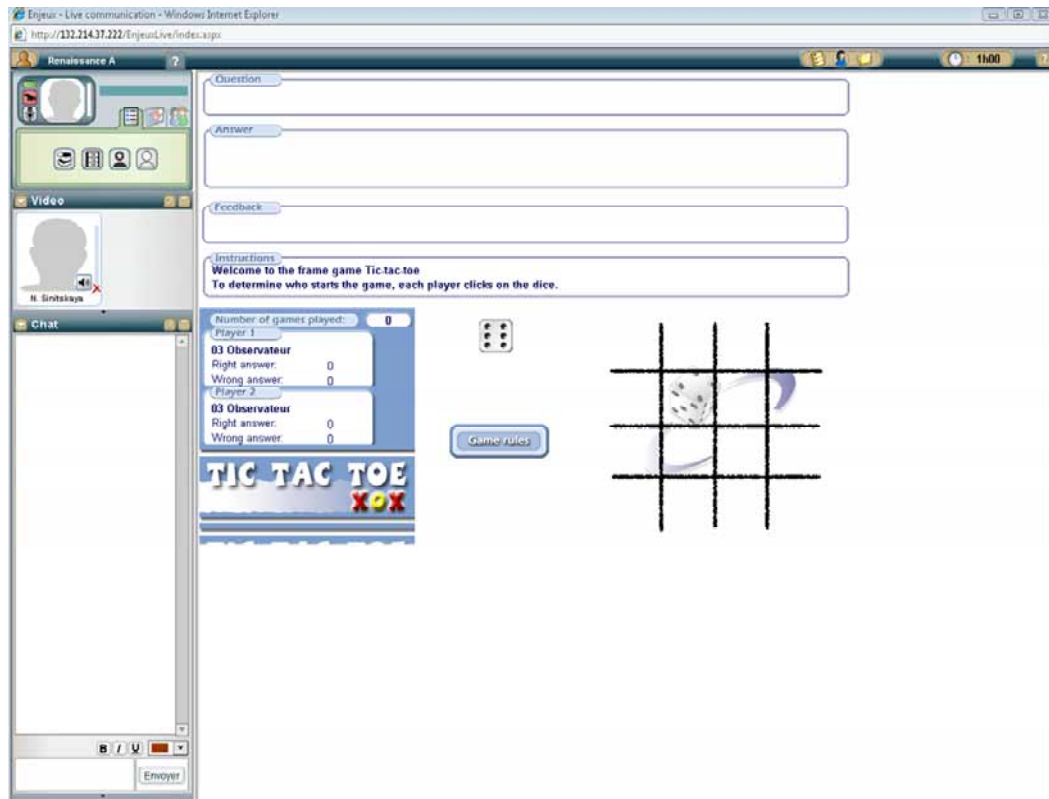*Figure 3.* ENJEUX Advanced Gaming Environment: Waiting Room

Figure 4. ENJEUX Advanced Gaming Environment: Game play

Research methodology

A qualitative study was conducted in the two schools using a case-study methodology (Yin, 2003). Data were collected during two phases of the project implementation. In the first phase of game creation by the students, two observations were carried out in each of the two research sites. Field notes and photographs were taken at the sites, and student-created games were used as data. During the second phase of the project implementation, observations were conducted in the school where videoconferencing was taking place, and field notes and photographs were taken.

Data analysis

The data were analysed using the grounded theory approach (Strauss and Corbin, 1998), where data collection, analysis and theory were closely interlinked. The analysis was not conducted with a preconceived theory in mind, but rather theoretical constructs emerged from data. Qualitative data which included field notes from our observations, transcripts of interviews with the teacher and the students, photographs, and students' games have been coded based on our initial research questions. The data were then analysed using Atlas.ti qualitative software. We identified key themes and issues pertaining to issues of gaming for literacy development, collaboration and engagement, and pedagogies of technology. The emergent findings have been arranged according to the two phases of the project implementation, and the most salient outcomes of the project.

III. FINDINGS

Phase 1: Game development
In Phase 1 of the project, students in two classes were involved in creating games using the Educational Game Central shells on the topic of their choosing. A total of 19 games were created as a result of this phase, seven in class A and twelve in class B. The findings of this phase of game development are summarized below.

Impact of game development on French-language literacy skills
Creating the games using an authentic French-based game interface proved to be an effective approach to encouraging interaction in French, the language of instruction in both schools. The environment allowed for the use of French pertaining both to the curricular content, and the use of technological vocabulary describing various functions of the Internet browser, and the computer. Teachers consistently used French with their students, whether for providing instructions about the game, feedback about the content of the game, or for classroom management purposes.

Students' use of French for interaction was less consistent. In class A students used both French and English. French was used in whole-class contexts or when addressing the teacher. In small-group work a mix of French and English was used, with English emerging in moments of high engagement or frustration; when students were referring to experiences that they have had in English (such as playing a video game which are predominantly English-based), or to clarify points that were unclear when articulated in French. In class B students also mixed French and English, with English used when they did not know how to say something in French (e.g. Est-ce qu'on [Do we] join le "wireless network"?), as a shortcut when they need a quick response (e.g. Which Internet window do I open?), or when using English-language material for their game creation.

In comparing the materials that students used for their game development, most students in class A used French-language sources, including educational websites, Wikipedia articles, textbooks and recreational materials. One group was observed using a book in English and translating the material into French. In class B however students were using materials, such as websites, which were primarily in English, and were translating them with the help of an online translator, BabelFish. Students also called on the teacher and the researcher to translate vocabulary they did not know.

Students were observed paying attention to language form. In class A the teacher stressed the importance of making questions that are correct from the point of view of both grammar and spelling, and several students in this class were observed discussing points of grammar (e.g. whether to use the singular or plural of a noun) and spelling (e.g. how to spell homophones).

Students made an effort to create questions that were challenging and motivating for the other players. In class A group of boys created a number of difficult questions before they realized that they needed to make simpler ones too. In class B one student inquired whether it was possible to create 'trick' questions, and was motivated to make the game more challenging. Students in this class also expressed a desire to continue working on their questions at home, thus demonstrating that they were motivated to create high quality questions. However, in the same class one group of students was observed completely disengaging after finishing the 'required' number of questions and creating questions off-topic just to fill the space.

The analysis of the game content revealed that most students focused on factual (Who? Where? What? Which? How many?) questions that mostly required recall of previously acquired information. Since several groups in both classes were creating games on non-curricular materials, they used external sources of information to research obscure facts about their topic. Questions created out of those obscure facts were difficult for other teams to answer correctly.

- Questions in class A were for the most part grammatically correct, with correct spelling and sophisticated use of vocabulary pertaining to the topics of the games. Some examples of the questions include: Combien d`années prend la lumière de l`étoile la plus lointaine pour atteindre la Terre? [How many years does it take the light from the farthest star to get to Earth?] (difficult)
    1. Des milliards [Billions]
    2. Des millions [Millions]
    3. Des centaines [Hundreds]

- Parmi ces organes, lequel n`a pas rapport au système digestif? (moderate)
    [Which of the organs does not belong to the digestive system?]
    1. Poumons [lungs]
    2. Estomac [stomach]
    3. Intestins [intestines]

- Si tu attéris sur le premier but est-ce que il ou elle pourra te toucher avec la balle? (easy)
    [If you get to the first base, would the player be allowed to touch you with the ball?]
    1. Oui [Yes]
    2. Non [No]

In class B students also created mostly factual recall questions. Their game types varied more significantly, with several groups opting for Trivia games which are harder to create due to a larger number of questions required for the game to function. This group of students had

more problems with grammar and spelling, particularly with homophones and participe passé vs. the infinitive. Students in this group also had a significantly larger number of incomplete games, which can be attributed to the fact that their game types required significantly larger amounts of questions.

Some examples of questions created by class B include:

- Quelle etait le nom du vaisseau spaciale que Luke a ecrasé sur le planet de Yoda.
  [What is the name of the spaceship that Luke has destroyed on Yoda's planet?] (difficult)
  1. At-Te
  2. X-Wing
- Les garçon peuvent joué les sports avec les filles.
  [Boys can play sports with girls] (easy)
  1. Oui. [Yes]
  2. Non. [No]

Math questions were in the form of equations (e.g. 42,23 x 86,43=3639,9389) and word problems (e.g. Carla a alle aux magasin et elle apport 72,13$. elle veux acheter des pantalon qui coute 21,49$, un chapeaux qui coute 3,76$, des chaussure qui coute 10,56$ et un chandail qui coute 31,39$. Elle avait assai d`argant.[Carla went to the store and brings 72,13$. She wants to buy pants that cost 21,49$, a hat that cost 3,76$, shoes that cost 10,56$, and a sweater that costs 31,39$. Does she have enough money?]).

Development of digital literacy skills
Games have been seen as a strong vehicle for developing not only traditional literacies, but contemporary digital literacies. These literacies include being able to interact with computers, access and navigate different digital environments, trouble-shoot problems, as well as access and evaluate information online. Students had access to computers in both classrooms, with class A having 6 desktop computers; and class B having a mobile laptop lab of 10 Macs and 2 desktop computers as well as a computer lab with 22 desktop terminals.

Students had a varied level of comfort with technology. In class A, some students showed an extreme proficiency with computers, accessing different websites (such as Cyberqu@rtier, a collaborative environment for students, or educational websites in French). They were also attempting to trouble-shoot problems themselves (in one case a mouse stopped working, and the boys decided to fiddle with the connections before they called on the teacher for help). Other groups in class A however were extremely insecure with the gaming environment: one such group was observed completing all the required fields in the game identification correctly before erasing everything and asking the teacher for assistance. In class B students showed a more consistent level of independence, relying on their own skills and the skills of

their peers to navigate the online environment and trouble-shoot the problems with the machines. Students demonstrated a sophisticated knowledge of the Internet: for example, in response to one student's question "Which Internet window do I open?", another student responds "Firefox…it's the best". Students in class B encountered some problems with the wireless connection, which they attempted to trouble-shoot with the help of one of the researchers. On a second visit several students encountered a problem with the game shell that was due to a missing piece of software, Flash player. Due to restrictions on software installation on the school's computers the problem could not be resolved.

Students also used the Internet as a reference source for their games. Class A students were observed using Wikipedia in French (see Figure 5), as well as printouts from educational websites in French. Students in class B used a variety of websites, all of them in English. They also used BabelFish online translating website to translate their questions from English into French. This resulted in a number of grammatical and vocabulary errors which the students did not pick up, trusting in the accuracy of the online translation. As this instance demonstrates, online tools should be approached with caution in language learning contexts, and students should receive training in using online tools such as translating websites.

Figure 5. Student in class A using Wikipedia for his research

Student motivation, engagement, and collaboration strategies
The game development project was a means of motivating students and engaging them into literacy activities on several levels. First, the technological aspect was a motivating factor: students in both classes were eager to go on the computers, use them independently to produce content, and engage with new digital environments with their partners. The gaming environment also added to the excitement of using computers, since many students were familiar with interactive gaming environments, and appreciated the use of tools that are traditionally considered recreational in formal instructional environments.

Second, the topic selection was a motivating factor: in both classes students have developed games on the topic that was of interest to them. Most students were observed working hard on creating game questions, bringing in additional materials and conducting their research both at home and in class to ensure a good quality of questions. The students were also very motivated by the competitive aspect of the game, and the fact that their peers will be playing the games drove them to create questions that were difficult or 'trick'. Students in both classes were observed being consistently on task, engaged with technology and motivated to perform well on creating a challenging game for their peers to play. The photo depicts a group of students engaged in the game creation activity.
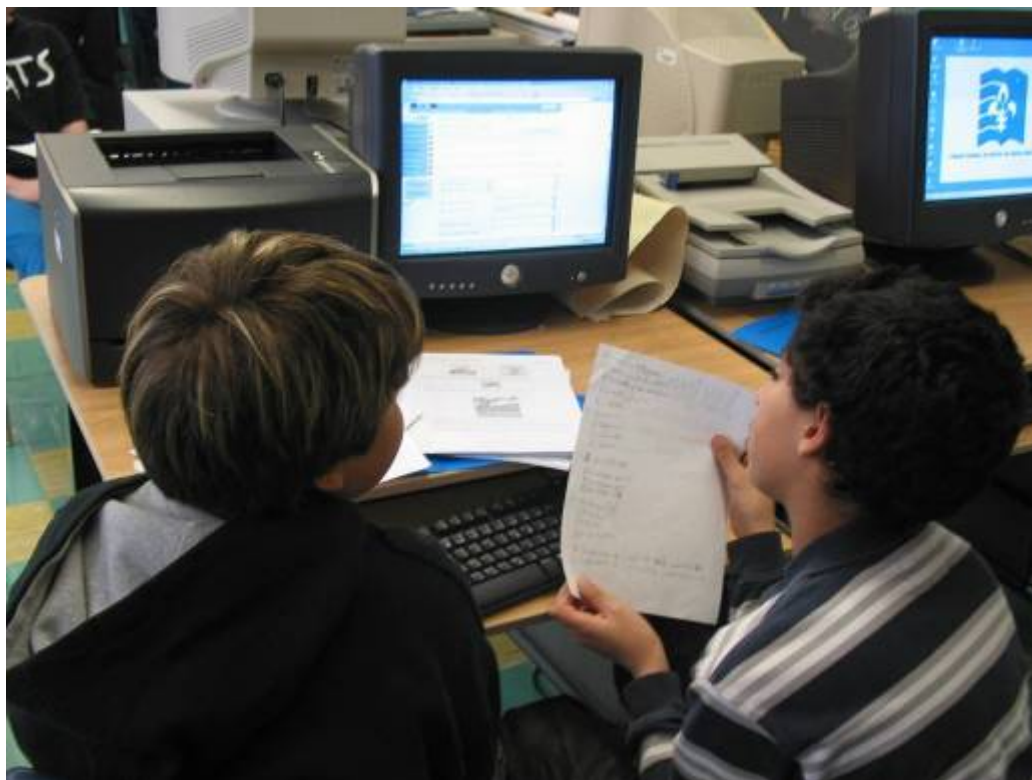

Figure 6. A group of boys engaged in creating their game.

Collaboration was a key component in the game development activity, and students were collaborating effectively in trying to create effective games. Teachers encouraged student

collaboration by splitting them into groups of 2-3. The teacher in class A allowed the students to select their partners themselves, which seemed to have served as an additional bonding factor between the group members. The teacher in class B assigned groups by proximity in the classroom, but students had an opportunity to protest the group assignments if they wished. In both classes groups were free to choose the topic for the game which was of interest to them, and students were eager to collaborate with their peers who shared the same interest as themselves.

Students were observed collaborating not only within their group, but also across groups. In class B, for example, students were offering each other assistance when there were problems with technology. The groups in both classes seemed to have worked out the roles that each team member would play: in some groups one person was typing, while the other was reading the questions; in other groups, the students switched roles to give each team member an opportunity to do every task. One such group is presented in the Figure 7: the three girls constantly switched places in order give each member of the group a chance to type, read the questions, and check the accuracy of their questions.

Figure 7. A group of girls are collaborating to develop their game.

Teacher classroom practices

Teachers in both classrooms had excellent rapport with the students, and were showing a firm grip on the classroom management. Both teachers had a very comfortable, hands-on approach

to teaching with technology. In both classrooms technology has become part of the classroom ethos, where the teacher in class A routinely includes computers into his practice, allowing students to work independently on the computers, while the teacher in class B uses a mobile laptop cart and projector as part of her classroom routines.

The teacher in class A seemed to have more flexible pedagogies around computers, not making a distinction between 'class time' and 'computer time'. Students in his classroom were observed using the computers when they needed something done, not when they were instructed to go on the computers. This pedagogical approach can be attributed in part to the teacher's experience with teaching split grades, where pedagogies have to be flexible in order to cater to all students in the class. The teacher's experience and comfort with technology was another contributing factor.

The teacher in class B had more controlled practices of computer use. For example, the teacher made sure that she was the one distributing and collecting the laptops, and students were allowed to start working only when the teacher instructed them to. This of course may be attributed to the fact that the class was relatively large and the teacher wanted to prevent off task behaviour.

That difference notwithstanding, both teachers had a remarkable comfort and control of technology. When faced with technological glitches and problems, both quickly found solutions that allowed for the productive work of the students to continue. For instance, in class A one computer stopped working, and the teacher simply relocated the group to another station. In another instance, the game that the students were playing as practice had a glitch, but the teacher laughed it off together with the students, and continued on with the activity. In class B, the teacher encountered a serious obstacle when half the class was unable to use the game shell because a piece of software was not installed on their terminals. The teacher asked the students to create questions for their future games in a word processor instead, thus demonstrating flexibility and not detracting from the students' computer time or game development process. In both classrooms the teachers were helping students with technology, checking their progress and assisting them with the content. In class B the teacher offered help with the vocabulary, and used those moments to teach unfamiliar words to the students.

The teachers' pedagogies of technology use show a remarkable balance of hands-on and planned integration of computers into their everyday practice, which allowed the students to immerse themselves into technologies and make them part of their learning.

Phase 2: Game play using ENJEUX-S, an advanced videoconferencing environment

The second phase of the project involved groups of students from class A in a competitive play against each other. In order to simulate the remote gaming environment, two computer stations were set up in neighbouring classrooms. The teacher and the research team did the

set-up of the environment, and despite an initial login problem the environment functioned well throughout the session. A total of 5 games were played, 4 *Snakes and Ladders* and 1 *Tic Tac Toe*.

Impact of videoconferencing on language development and use

Game play using video conferencing software offered an effective and authentic environment for developing language skills. The video conferencing component allows the players to communicate between each other, and the students in the study used this functionality for a number of purposes. First, they interacted about the game set-up and the administrative problems that occurred during game set-up and play (e.g. if they couldn't hear, or if the game wouldn't start on their end). Students also directed much of the interaction towards teasing the other team and building their own competitive spirit. Some of the examples of students' conversations include "On va gagner, vous allez avoir un souris" [We're going to win, you're going to have a mouse].

The game play itself encouraged some skills of language decoding (in reading the questions and the answers) and production (in discussing the correct response). The observations have shown that answering questions quickly was the most important factor in most teams' game play, often at the expense of accuracy of their responses. The teacher encouraged the teams to communicate amongst each other, and discuss the responses before they chose the final one. However, frequently the response was chosen before all members of the team had a chance to share their opinion.

Because of the way the games were designed, *Snakes and Ladders* did not allow for a lot of questions to come up which significantly limited the possibilities for student language development. At the end of the session, we requested that two groups of volunteers play a *Tic Tac Toe* game. The result, as we expected, was more questions for the students and more interaction between them.

As with the game development, game play seemed to be accompanied by a mix of French and English. English was mostly used for off-task interactions, exclamations and cheering, and was used only when no figures of authority were visibly present.

Development of digital literacy skills

The ENJEUX-S environment combined many aspects of sophisticated sociable technologies that are particularly appealing to students. The students were deeply engaged with the environment, and appreciated the interactivity, the video and audio components, and the gaming itself. The experience of using an advanced gaming environment with many digital functionalities had a lot of benefits in terms of learning new digital skills.

Particularly, students learned how to control and be in charge of sophisticated digital technologies. The first group of three girls (see Figure 8) that was playing initially had trouble controlling the technologies, and the teacher had to instruct them what to do (press the button of the microphone to speak, look at the camera), and what to say (e.g. say 'On ne vous entend pas' [We can't hear you] when they couldn't hear the other group). Eventually however the girls got more in control of the process, and were happy to take charge of the technology. When one girl got tired of controlling the game, she demanded to be allowed to control the microphone.

Figure 8. A group of girls engaged in competitive game play.

Students also showed different patterns of collaboration, particularly when it came to delegating and distributing the roles. In some groups, one person was assigned control of one function, e.g. one person was holding the microphone and talking, another person was controlling the mouse, and the third person was reading the questions out loud to the group. In other groups, the functions of the team members were more flexible, and all group members were performing all of the functions. In some groups there were dominant members who did not allow for other participants to contribute as much as they would have liked to.

As a result of this activity, the students had an opportunity to familiarize themselves with the technologies of the future; technologies that up to this day remained in the 'adult' realm. They experienced video and audio possibilities of online interactions, and understood the

working principles behind webcam communications. They also used these skills to engage in competitive game play which had an authentic flavour to it.

Patterns of motivation and engagement
Students showed extreme levels of motivation and engagement in the game play activity. Given that they had put much effort into creating their games, they saw the final activity as a culmination of their efforts. The opportunity to compete against other teams was also a strong motivating factor. There seemed to be an inter-gender rivalry as well as the inter-team rivalry. Since in the first competition the girls' team won against the boys, before the second round the boys were driven to "not lose again to the girls". The competitive aspect also translated into the students making sure that the game play was fair. They used the webcam functionalities to observe the other classroom, and made remarks using the microphone if they suspected that someone was cheating. One group was so convinced that someone was helping their rival team, that one group member volunteered to go and check if the other team was getting help. This demonstrates an extreme level of engagement and commitment to doing well. The students were visibly motivated during the game play, cheering each other on, teasing the other team. They were upset when they lost and happy when they won, as is expected in any competitive game play activity.

The technology itself served as a great motivating factor. Not many students, it seemed, had experience with a web camera before, and the first few minutes with every team were spent exploring its functionalities. One group of boys carefully adjusted the camera, played with the microphone, and waved to the other team, watching that they can see themselves on the screen (see Figure 9).

Figure 8. A group of girls engaged in competitive game play.

Figure 9. A group of 3 boys is exploring the videoconferencing environment, waving to their opponents.

IV. DISCUSSION OF RESULTS

This project investigated how the use of advanced gaming environments affects students' learning, literacy, and gaining insights into an effective pedagogy of technology use. Our observations of students creating the games and playing them suggest that web-based gaming environments can serve as an effective and engaging means of developing French-language literacy. Primarily, the games have provided an authentic French environment for the students to interact with, and allowed for the use of contemporary French in reference to the new digital media. Students have had ample opportunities to use French in doing the research for their games, and in creating game questions. On the flip side however, students were tempted to "shortcut" and use English whenever the situation allowed, especially in situations which were not monitored by the teacher. This suggests that further work is needed in order to establish the episodes in which students are most prone to using English, and suggest ways to limit those situations.

Students not only got the opportunity to develop their French literacy skills, but also became more conversant in digital literacies. Students in the game creation classrooms had the opportunity to use new and engaging media to create interactive games. They acquired more skills with navigating the web environment, accessing the web, and using appropriate vocabulary to describe various digital artefacts and functions. In the video conferencing activity the students had the opportunity to interact with and control the cutting-edge technologies that up to this moment were off-limits to them, thus increasing their level of comfort and engagement with the versatile digital technologies of today. They also used the Internet to do research for their game questions. However, students in one of the classes did so uncritically, using the material in English and translating the questions into French with the help of a web translator. The result was poor question quality. This finding can be used to further probe the critical dimension of using the Internet in the classroom, and investigate the possibilities for evaluating the content accessed online.

The activity allowed the teachers to engage students in motivating and literacy-rich activities. Students were motivated by the novelty aspect of the game, by the use of the technologies, and by being able to put their own interests and strengths into the game. Perhaps one of the most significant gains that we observed was the amount of team work and emerging collaboration that helped the students create better games. Students were engaged in different patterns of collaboration, working both within the groups and across them, offering each other help. Students also demonstrated that competition and rivalry was a serious aspect of their involvement in the activity. Creating good games was not just a matter of doing well in school, but also an opportunity to show the other teams what they were capable of.

In this study we also aimed at investigating the effective pedagogies of computer use in literacy instruction. In the course of the project the teachers demonstrated the use of various pedagogical approaches, and the most successful ones were non-linear and flexible approaches. Effective use of technology in this project was characterised by the teachers taking ownership of the technology and its tools, incorporating them into their teaching practice, and most importantly, allowing students to explore and get comfortable with the technology. The most telling examples of how successful pedagogies of technology worked in this project came from instances in which the teachers had to deal with breakdowns or problems. Both teachers in the project took control over the technology, rather than had the technology control their classroom, and found ways to work around the technological glitches without negatively affecting their pedagogical goals.

V. CONCLUSIONS

This project examined how advanced gaming environments such as a web-based game shell and a videoconferencing collaborative tool can be used to develop students' French language and literacy skills. Our findings suggest that both game development online, and game play using advanced collaborative environments can be an effective tool for fostering students' literacy through immersing them in rich language environments and offering them multiple opportunities for collaboration. The gaming activities were also seen as a successful vehicle for developing students' digital literacies through exposing them to diverse technologies which allowed the students to experience and develop sophisticated skills of browsing, accessing, and communicating on the web. However, we also found that students need more critical literacy skills in using the Internet, specifically in instances of using a web translator.

These preliminary findings warrant more research into the area of language and literacy development through the use of interactive web technologies. Specifically, when it comes to using a second language in the classroom, students interact both in the target language and in English. Further research could shed light on the influence of English-saturated Internet technologies on the learning in languages other than English. Moreover, research into the possibilities of remote collaboration via video conferencing can help determine the impact that advanced Internet technologies can have on learning and literacy.

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