

# Facilitating the Adoption of Public Services Using High Definition Video: The Case of Primary Education

*Completed Research Paper*

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## ABSTRACT

The adoption of innovative Information and Communication Technologies (ICTs) in public services in general, and in education in particular has intensified in the last few years. Although electronic services in learning has been used in primary, secondary and higher education for some years, the use of live video technology to facilitate public services has rarely been explored before. In this paper, we focus on the adoption of high definition video-to-video (V2V) communication in the context of public sector primary education. This paper examines how V2V technology can be utilised in encouraging collaborative learning initiatives among different schools. Results of a preliminary case study are presented highlighting some of the technical and users criteria required to ensure a successful adoption of video-to-video communication in the context of education.

## Keywords (Required)

Public services, education, video-to-video communication, learning, ICT adoption

## INTRODUCTION

Despite efforts to integrate ICT in public services, and despite of the promised benefits, adoption has failed to meet initial expectations (Cordella and Contini, 2012; Ferro and Molinari, 2010). Among existing public services, in this paper, we focus on education services and how to use video-to-video communication within the context of primary education to facilitate collaborative learning projects among different schools. Although the use of video-to-video communication in the educational context is not necessarily new and it appears to offer a greater course audience, making use of a particular teacher expertise and connecting remote students with their teachers, “its use within an educational context is still not well understood” (Burns, 2012). Moreover, previous research reported problems with video-to-video communication due to technical problems that led to delays and poor sound and image quality (Bruns, 2012). When confronted with these technical problems “it becomes an almost impossible goal” for teachers to follow best pedagogical practices (Bruns, 2012), affecting as a result the learning process (Gage, 2003). The necessity of a high definition video-to-video communication is highlighted in a study by Celikkan et al. (2013) which posit that it is necessary for nursing students to see the details of the procedure performed during classrooms and clinical skill labs. In this respect, the image quality of the video can have negative effects on the capacity to assimilate information (Ghinea and Chen, 2008; Hooper et al., 2007) and time delays in video-to-video communication have been shown to negatively affect learning in different contexts, i.e. language learning (Laouénan and Stacey, 1999; Yang and Chen, 2007). Moreover, when technical problems occur during video-to-video communication, student interest and participation is affected (Payne et al., 2006). This research, done in the context of the LiveCity project (Chochliouros et al., 2012); aims at facilitating high definition video-to-video delivery by alleviating previously reported problems related to network delivery.

This paper focuses on the evaluation of video-to-video services, in the educational context. With this aim, we plan to determine what the critical factors necessary for the adoption of a video-to-video service are from the teacher and student perspective. To do so, we performed an in-depth interview with the principal head master of the leading school in Dublin, Ireland as part of the LiveCity project (which is an ICT PSP project funded under the European Commission’s Framework Program 7). To realize this research aim, this paper is structured as follows. The next section presents previous work related to the usage of video-to-video in educational settings. After that we discussed the proposed video-to-video usage scenario. Next section highlights the interview results, followed by a discussion to synthesize the key findings in relation to the

literature. The paper then concludes by outlining the key findings, outlining the research limitations and pointing future research directions.

### **USAGE OF VIDEO-TO-VIDEO IN EDUCATION**

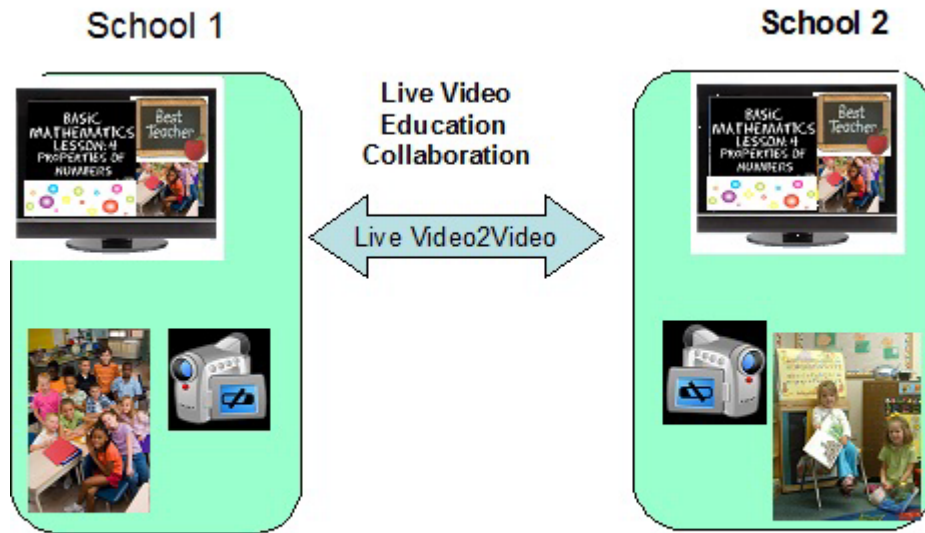
Technological advances have made video-to-video communication possible and have led to its increasing use in educational settings (Lawson et al., 2010). Initially, video-to-video communication and videoconferencing has been used as a variant of distance learning characterised through its ability to provide synchronous communications between learners and teachers found at different locations (Lawston et al., 2010, Offir and Lev, 1999). As a result, the initial usage of video-to-video communication has been aimed at increasing the students' intake (Cochrane, 1996; Knipe and Lee, 2002), savings in terms of travel time and travel cost both for students and teachers (Lawston et al., 2010), and cost-effectively reaching remotely located students that otherwise would not be exposed to the same learning opportunities (Bates, 2005). Dal Bello et al. (2007) showed that the use of video-to-video communication exposed teachers to situations that otherwise they would not encounter. From the student perspective, it has been shown to enhance language learning (Reed and Akers, 2013; Yamada, 2009) and promote collaborative activities (Wright and Cordeaux, 1996). Furthermore, when connecting students from different locations, it has the potential to foster cultural awareness, improve understanding and respect towards others (Lee and Hutton, 2007). In addition, collaborative learning has been shown to improve learning achievements and learner experience (Gokhale, 1995; Johnson and Johnson, 1986; Zha and Ottendorfer, 2011).

Despite the potential offered by video-to-video communication, its utilization is still at an early stage and it does not always receive positive reactions from users (Lawston et al., 2010). This has hindered its adoption, despite its well-established educational potential. Therefore, eliminating or at least alienating technical problems and involving the potential users (teachers/students) in designing the requirements of such a system has the potential to increase its adoption. Moreover, the use of high definition video has the potential to improve the online social presence (Cui et al., 2012). In this respect, the concept of the LiveCity project in the context of education is to facilitate the adoption of such service with the end aim to improve educational outcomes. This paper outlines the findings of a preliminary case study that was conducted as part of the LiveCity project to explore the potential of high definition video use in a primary care setting.

### **USAGE OF HIGH DEFINITION VIDEO TO VIDEO IN LIVECITY CONTEXT**

The concept of the LiveCity project argues that high definition video-to-video communication can be used to connect different schools to facilitate and implement various projects that will contribute to learning and teaching (see Figure 1). The projects can have different aims such as promoting literacy, the study of local culture, or improving sports education. Video-to-video communication can connect two schools or multiple schools at the same time. It can also connect schools with museums (museum curators) to enhance student knowledge about different cultural heritages across the world. On the other hand, to promote literacy, students can be invited to discuss and work collaboratively on an essay or interpret a story as a dramatic piece a local historical folklore/legend that is structured based on the relevant curriculum objectives. This has the potential to not only improve literacy and integration of different subject areas, but also to increase student knowledge about each other's heritage. The use of video-to-video in this scenario facilitates a better collaboration and the ability to see other students' reaction to the work presented.

For a subject such as arts, students from different regions/countries could present each other a piece of local art using high definition, real time video. In this context, students from two different cities can exchange ideas and explain to each other the importance of local heritage. Also, students could be connected through a museum curator, who could show them the exhibits the museum has. The students have in this way the opportunity to ask the curator questions regarding the exhibits presented.



**Figure 1 Video to Video Communication (adopted from Chochliouros et al., 2012)**

As outlined in figure 1 above, using video to video schools can collaborate with each other to share learning and teaching experiences regardless of the location. In this way V2V can also facilitates cultural interactions between the schools and/or other cultural institutions across the world increasing the awareness of arts, science, and social issues among students of different nations. Such a model supports the idea of the development of ‘global citizens’ and helps young people appreciate each other’s cultures. In the long term therefore, V2V can help create in the long term a global society that is more tolerant of each other and societies.

## CASE STUDY

The purpose of this study is to determine the relevant criteria for the successful adoption of video-to-video services in educational settings. Considering the importance of involving relevant stakeholders in the implementation of ICT in public services (Goel, et al., 2012; Currie, 2012), understanding teachers’ perception of using video-to-video communication in education is imperative before such services are implemented in an educational setting (Bruns, 2012). In this respect, it is important to find out what criteria are necessary to facilitate a successful adoption of video-to-video services. With this aim, we performed a preliminary interview with the principal teacher of an Irish primary school. The interview was semi-structured with open-ended questions. Semi-structured interviews are the most common used tool in qualitative research in information systems (Myers and Newman, 2007). Through the interview, several criteria have been identified that can be divided broadly in two categories: technical criteria and criteria related to the user. The interview was conducted in October 2012 and tape recorded with the permission of the principle teacher. The findings were then transcribed into MS word and manually analysed scanning for Technical and Non-technical (user) related themes. Since the purpose of this study was focused on initial exploration of the concept of V2V use in an educational setting and not generalisation, a single in-depth interview was deemed adequate to fulfil the overall aim of the study.

### Technical Criteria

Technical criteria refer here to problems that appear due to technical difficulties, either related to data communication and networking issues or at the application level when transmitting and using video services. As outlined by the principle teacher, having a “*stable and reliable network and application*” is considered as one of the most important features for engaging both students and teachers in using any V2V application. The PT highlighted that “... *there is nothing worse for teachers than maybe, in the initial day of Internet access you call up a site, maybe you want to go on an exploration visit or something like that of the website and it breaks down, and then you lose the children. And then you do not come back to visit the next day because you know it is not stable... the biggest issue for my staff has been stability*”.

The PT also insisted that video quality is important for maintaining both teacher and student interest: “*If the quality is not high teachers lose interest. And do not capture children attention.*” The PT explained that this is mainly due to both teachers and students being exposed to high quality video in everyday life and therefore expect the same high quality also in a school

context. This is consistent with previous research which highlights that quality of audio and video depends on the recipients' experience (Watson & Sasse, 1998). On the other hand, the PT highlighted the need for security when using V2V services by stressing that *"security is an issue for the parents because they want to know that their children are safe when they go online"*. In the context of video, *"we will need to ensure that children only interact with their teachers or with each other and are not exposed to any others without prior consent from parents."*

### User Criteria

The users of the video-to-video service in this case are both the teachers and the students, and as such criteria were highlighted for both of these groups in terms the usability of the applications and content that will be delivered using V2V.

#### *Criteria that may influence Teachers' use of V2V for Education*

The PT outlined that improvement in teachers' knowledge/skills as a result of interacting through video-to-video with other teachers who have different approaches and experience levels in teaching is an important aspect that will ensure the adoption of such services: *"I think the interactions from the teachers will allow each of them to experience what the other has to offer and maybe share practices. We all get good ideas. I think not only will the kids learn through the process but the teachers will also learn because every experience has some value in it"* (PT).

#### *Criteria that influence Students' use of V2V for Education*

As a result of interacting through video-to-video, it is expected that this will increase student knowledge in the same way as the traditional method of teaching would: *"the standard expectations that we have when we teach any subject to the kids are still there"* (PT). In addition, it is expected that students' presentation skills will improve: *"I think the standard of presentation will improve, as well as their social skills and emotional development"* (PT). Moreover, it is expected that the use of video-to-video will increase student engagement with the subject and the effort put in the presentation, as they will need to present to one another: *"I think the standard of presentation will improve. I think the standard of effort that goes in preparation will also improve"* (PT).

## DISCUSSION, CONCLUSION AND FUTURE RESEARCH

This paper has outlined how high definition video-to-video has the potential to facilitate collaboration of people between different locations in a cost effective manner. To determine the criteria necessary for the successful adoption of video-to-video communication, a preliminary study was performed in the context of the LiveCity project, which is funded by the European Commission under the FP7 ICT PSP program. The empirical findings identified in the case study conducted were discussed in terms of technical and user related criteria that influence the adoption of V2V services in an educational setting. The technical criteria refer to parameters that are considered important from the network and the application point of view. The parameters identified in the study are: stable and reliable network and application, high definition video connectivity and the need for ensuring security. The user criteria were related both to the teachers and the students as the users of the application. For both of them it was considered important that they will improve their knowledge/skills. Teachers are expected to improve their teaching strategies through interacting with other teachers. For the students, it is expected that they would learn the required material as in a "traditional" classroom settings, but will also improve their presentation skills by putting more effort in preparing for the classroom. It was thought that using V2V will encourage students to put in more effort in the preparation of their presentations for interaction with other students/teachers they have not met or had any contact with before and whose expectations are not known. Moreover, through interacting with other students/teachers it is expected that the student social skills and their emotional development will improve.

The theoretical and practical contributions of this paper are a number of high level criteria that need to be considered for evaluating video-to-video communication in an educational setting. These findings are useful for policy makers, decision makers, and educational content providers in order to assess and determine the success of video-to-video communication. The study showed that attention should be paid to both technical and user aspects involved in delivering video-to-video.

There are several limitations when using this study. The empirical findings were obtained from a single in-depth interview. The opinions are based on the principal teacher's previous experience in using technology in classroom situations, but not on the actual usage of the system. Therefore, future research is planned to evaluate the use of V2V during the actual implementation and use of the technology in a primary care setting as part of the LiveCity project. This will involve the evaluation of the V2V concept in the context of a pilot implementation planned to link schools in Athens, Dublin and Luxemburg as part of the LiveCity project.

Further studies will be performed with a higher number of teachers coming from different countries, and having different levels of experience with technology to validate the factors determined. Moreover, these will be validated and re-fined as a result of usage of the application in a real context.

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## REFERENCES

1. Bates, A. W. (2005) Technology, e-learning and distance education. RoutledgeFalmer.
2. Burns, J. T. (2012) Evaluating staff development and training models to support the implementation of videoconferencing technology for teaching and learning in a distributed University. *Quarterly Review of Distance Education*. 3(3). <http://www.eurodl.org/?p=archives&year=2002&article=62>
3. Celikkan, U., Senuzun, F., Sari, D., and Sahin, Y. G. (2013) Interactive videoconference supported teaching in undergraduate nursing: A case study for ECG. *Educational Technology & Society*, 16, 1, 286–294.
4. Chochliouros, I., Spiliopoulou, A., Sfakianakis, E., Stephanakis, I., Morris, D., and Kennedy, M. (2012) Enhancing education and learning capabilities via the implementation of video-to-video communications. *Artificial Intelligence Applications and Innovations*, 268-278.
5. Cochrane, C. (1996) The use of videoconferencing to support learning: An overview of issues relevant to the library and information profession. *Education for Information*, 14, 4, 317-30.
6. Cordella, A. and Contini, F. (2012) Socio technical regimes and e-government deployment: The case of Italian judiciary. *Proceedings of the European Conference on Information Systems*, June 10-13, Barcelona, Spain. <http://aisel.aisnet.org/ecis2012/27>
7. Cui, G., Lockee, B. and Meng, C. (2012) Building modern online social presence: A review of social presence theory and its instructional design implications for future trends. *Education and Information Technologies*, 1-25.
8. Currie, W. L. (2012) Evaluating the governance structure for public sector IT: The UK National Programme in the Health Service. *Evaluating Information Systems*, 199-217.
9. Dal Bello, A., Knowlton, E., and Chaffin, J. (2007) Interactive videoconferencing as a medium for special education knowledge acquisition in preservice teacher education. *Intervention in school and clinic*, 43, 1, 38-46.
10. Reed, D. K. and Akers, C. M. (2013) Connecting adolescents with their geographically separated parents: Videoconferencing for reading support, *Preventing School Failure: Alternative Education for Children and Youth*, 57, 1, 43-48
11. Ferro, E. and Molinari, F. (2010) Making sense of Gov 2.0 strategies: No citizens, no party. *Journal of eDemocracy and Open Government*, 2, 1, 56-68.
12. Gage, J. (2003) Videoconferencing in the Mathematics Lesson 12.
13. Ghinea, G., and Chen, S. Y. (2008) Measuring quality of perception in distributed multimedia: Verbalizers vs. imagers. *Computers in Human Behaviour*, 24, 4, 1317-1329.
14. Goel, S., Dwivedi, R., and Sherry, A. (2012) Role of key stakeholders in successful e-governance programs: Conceptual framework. *Proceedings of the Eighteen American Conference on Information Systems*, August 9-11, Seattle, Washington, USA. <http://aisel.aisnet.org/amcis2012/proceedings/EGovernment/19/>
15. Gokhale, A. A. (1995) Collaborative learning enhances critical thinking. *Journal of Technology Education*, 7, 1. <http://scholar.lib.vt.edu/ejournals/JTE/v7n1/gokhale.jte-v7n1.html?ref=Sawos.Org>
16. Hooper, S., Miller, C., Rose, S., and Veletsianos, G. (2007) The effects of digital video quality on learner comprehension in an American Sign Language assessment environment. *Sign Language Studies*, 8, 1, 42-58.
17. Johnson, R. T., and Johnson, D. W. (1986) Action research: Cooperative learning in the science Classroom. *Science and Children*, 24, 2, 31-32.

18. Knipe, D., and Lee, M. (2002) The quality of teaching and learning via videoconferencing. *British Journal of Educational Technology*, 33, 3, 301-311.
19. Laouénan, M., and Stacey, S. (1999) A brief experiment in distance teaching and learning of French. *British Journal of Educational Technology*, 30, 2, 177-180.
20. Lawson, T., Comber, C., Gage, J., and Cullum-Hanshaw, A. (2010) Images of the future for education? Videoconferencing: A literature review. *Technology, Pedagogy and Education*, 19, 3, 295-314.
21. Lee, M. and Hutton, D. (2007) Using interactive videoconferencing technology for global awareness: The case of ISIS. *International Journal of Instructional Technology and Distance Learning*, 4, 8, 3-14.
22. Myers, M. D., and Newman, M. (2007) The qualitative interview in IS research: Examining the craft. *Information and organization*, 17, 1, 2-26.
23. Offir, B., and Lev, Y. (1999) Teacher-learner interaction in the process of operating DL (distance learning) systems. *Education Media International*, 36, 2, 132-136.
24. Payne, F., Gooday, M., Courts, N., Duncan, A., and Wolfe, A. (2006) The use of videoconferencing for learning and teaching: Evaluation of the Global Learning and International Classroom Project. In *Proceedings of Annual Conference Royal George Hotel Perth, Scotland*, 16.
25. Yamada, M. (2009) The role of social presence in learner-centered communicative language learning using synchronous computer-mediated communication: Experimental study. *Computers & Education*, 52, 4, 820-833.
26. Yang, S. C., and Chen, Y. J. (2007) Technology-enhanced language learning: A case study. *Computers in Human Behavior*, 23, 1, 860-879.
27. Watson, A., and Sasse, M. A. (1998) Measuring perceived quality of speech and video in multimedia conferencing applications. In *Proceedings of the sixth ACM international conference on Multimedia*, 55-60. ACM.
28. Wright, N., and Cordeaux, C. (1996) Rethinking video-conferencing: Lessons learned from initial teacher education. *Innovations in Education and Training International*, 33, 4, 194-202.
29. Zha, S., and Ottendorfer, C. L. (2011) Effects of peer-led online asynchronous discussion on undergraduate students' cognitive achievement. *American Journal of Distance Education*, 25, 4, 238-253.