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# The dynamics of mathematical connection using F2F or video conferencing

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## **Abstract**

A large majority of Australian academics, particularly mathematicians, have not been exposed to undergraduate learning by flexible delivery, whereas today's undergraduates are subjected to various forms of flexible delivery. The implementation of new technologies suggests academics neither experienced flexible delivery nor received training in effective curriculum design, good quality teaching strategies along with classroom management within this type of medium. Consequently their delivery of information/subject content using video conferencing is assumed to be identical as if the content was delivered by face to face (F2F). The contrast between video conferencing and F2F teaching can best be demonstrated in an analogy of its effectiveness and consequently student education to seat allocation at a rock concert. This paper discusses issues raised by both academics and students on the immediate affects of using flexible delivery in mathematics at a University of Wollongong offcampus site.

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## The dynamics of mathematical connection using F2F or video conferencing?

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### Abstract:

*A large majority of Australian academics, particularly mathematicians, have not been exposed to undergraduate learning by flexible delivery, whereas today's undergraduates are subjected to various forms of flexible delivery. The implementation of new technologies suggests academics neither experienced flexible delivery nor received training in effective curriculum design, good quality teaching strategies along with classroom management within this type of medium. Consequently their delivery of information/subject content using video conferencing is assumed to be identical as if the content was delivered by face to face (F2F). The contrast between video conferencing and F2F teaching can best be demonstrated in an analogy of its effectiveness and consequently student education to seat allocation at a rock concert. This paper discusses issues raised by both academics and students on the immediate affects of using flexible delivery in mathematics at a University of Wollongong off-campus site.*

### Introduction

There are various reasons why flexible delivery, such as video conferencing can be operated to deliver subject content. Video conferencing increases the educational access for students in rural or secluded areas. These isolated students have access to teachers and experts along with a 'social' connection with a larger student body. There is a sense of communication and belonging that aids in the process of student learning. In addition to this, video conferencing is to enhance student learning by using alternative methods to aid in the teaching process. This can best done by having the occasional short lesson/lectures that are interactive with both on campus and nonlocal students, such as, brain storming (Gage, Nickson, & Beardson, 2002) or having guest lecturers who are not available on site.

The motives for the implementation of video conferencing have been illustrated by Cochrane. He stated that it ensures "that students are exposed to a technology which is increasingly used in professional practice", and eases "course delivery problems" (Cochrane, 1996, p. 318). A case can be argued that video conferencing, as the newest technology for distance education. In deed with the introduction of improved technologies such as 'smart board' for immediate interaction between lecturer and nonlocal students, video conferencing now blurs the distinction between F2F teaching and distance education. Literature in this field has been growing at a steady rate (Mason, 1994; Gage et al. 2002; ANNIE project, 2003) to enforce this case.

Nevertheless, there is a question of pedagogy as the dominant educational need and requirement when determining the type of medium. Freeman (1998) critiqued the benefits of video conferencing. In his studies, he emphasised that both students and staff found the lecturing and learning activities were not improved by this method of teaching. Bollom, Emerson, Fleming, and Williams (1989) established that rarely was there potential for discussion or interaction with students when teaching in this context.

Child, Nicholls and Smith (2003), in their discussion session stated that video conferencing could not replace F2F, but it can add value particularly in specific teaching aspects.

Cognitive and pedagogical studies as well as curriculum designs on F2F higher education teaching have been extensive (HERDSA, 1992; Ramsden, 1992; Biggs, 1999; ACER (2000)). It can be concluded that video conferencing as the new technology has improved dramatically with the use of flexible delivery as a preferred medium. However, the value and richness that is obtained from face to face is immeasurable.

Most mathematics academics are learners too. Their level of ability to understand and learn is usually at a higher level than their students. An assumption by on-campus academics that having simply a 'co-presence' delivering lectures must be tempered by awareness that it may be seen as a disadvantage to off-campus students. Thus, academics must be cautioned on using technology without regard for learning outcomes (Kehoe, et al., 2005). Meeting the learning needs of nonlocal students is imperative when using video conferencing as a tool and medium facilitator.

Section 2 will discuss the reasons why F2F is dynamically, visually and emotively important as the quality educational tool for student learning. Section 3 is concerned with the need to change teaching style to take into consideration video conferencing to an off-campus facility along with tandem teaching at an on-campus facility. The behavioral management of off-campus classes using video conferencing and the importance of tutors will also be discussed in Section 3. Finally, Section 4 will be an early report on by both academics and student issues relating to the first delivery of video conferencing of two mathematics subjects by the School of Mathematics and Applied Statistics at the University of Wollongong to an off-campus site whilst tandem teaching on campus.

### **Face to face vs video conferencing**

As stated earlier, video conferencing has enormous advantages especially when students do not have access to other means of education other than by flexible delivery. Importantly, the process of learning is itself a communication process. The points below are a summary of why F2F is regarded as both a cognitive and emotive choices for content delivery to give the most beneficial and best quality of education to students.

- (a) Even in the new technology era, students have been raised and are traditionally developed with personal face to face learning, i.e. parents and teachers both primary and secondary.
- (b) F2F stimulates discussion/debate from all parties, ideally. The richness of creating student centred learning rather than teaching centred in this form is immeasurable.
- (c) Body language from students and lecturer are communicated directly via F2F. A lecturer's intonations/nuances/inflection are important factors in the delivery of content and therefore student education (Jarvela & Hakkinen, 2002). These are not conveyed via video conferencing.

- (d) Retention of student engagement during video conferencing is difficult. Technology does not allow the off-site lecturer to be sufficiently aware of the students understanding and responsiveness during their lecture.
- (e) All major communication programs are one to one (or F2F), for example, state visits of world leaders. This form of communication shows respect for one another. Hence, nonlocal students could feel discarded or detached (Lobry de Bruin, 2004).
- (g) A choice of rock concert seats is a good analogy regarding choosing F2F. The further away from the front stage the cheaper the seats. This is due to the fact that sound and vision (using screens) is of a lesser quality.
- (h) F2F develops a sense of involvement and relationship between students and lecturer. It allows the student to take ownership of the knowledge of the subject and its content.
- (i) Stemming from F2F is the promotion of academic quality of those staff that are directly involved with the teaching of students. Academics, hence will have a greater understanding of individual student needs which develops a strong relationship and bond that enhances the quality of student learning.
- (j) With small groups, F2F does not have to be held in a sterile auditorium/lecture theatre. Thus allowing and illustrating that the environment is an avenue for stimulating discussion.
- (k) F2F is more flexible more interactive as well as dynamic. Andrew & Klease (1998) stated there had to be more structure in communications when using video conferencing. Furthermore, in allowing their persona and in depth knowledge in F2F situations, the lecturer sets a positive atmosphere for learning. Video conferencing is merely two dimensional and therefore can be perceived as sterile by nonlocal students especially in the situation where they could have a choice of delivery.

The use of technology is expensive as there are hidden costs to the institution that involves not only technicians and costly equipment but the use of microwave band, software upgrades, etc. Academics are not aware of these costs and therefore, discount this when deciding if a F2F lecturer should be employed rather than using video conferencing. Thus the choice of mode of delivery should not be done on a 'technologies for technology's sake'.

## **Delivery via video conferencing**

### **(a) Changing Teaching Style**

Communications deal with intra and inter personal issues. As we know, human relationships and interaction are built on and require the medium of exchange to be 1 to 1 or via 3D communications. We, as humans, learn and develop through this type of medium of exchange of ideas and thoughts. Video conferencing is a form of e-learning which is the transfer of knowledge from one to another using technology but is, at its very best, 2D. Thus F2F is the optimum option for learning. As such, teaching styles should be changed or readjusted to reflect and off-set the lack of 3D communication.

Thompson (1996) states that video conferencing should be seen to use its medium at its optimum effectiveness rather than the lecturer delivering a monologue occurs in a conventional lecture.

Prior to engaging in this flexible delivery, lecturers need to become familiar with this new technology, its constraints/limitations and its communication capabilities. As a direct consequence, it is imperative that lecturers change their F2F teaching style(s) to cater for video conferencing (Andrews and Klease, 1998). This in itself can cause angst and be unproductive. For instance, ensuring that the lecturer remains in camera means that the positioning of lecturer is basically confined to a small bounded area near the lectern, computer or document camera. The visual impact to the nonlocal student can be referred to as a talking head syndrome and therefore, not conducive for dynamic interaction and student learning.

Mason (1994) states that additional preparation time are required by teachers to plan lessons and to ensure that the material for the video conferencing medium is considerably more visual than F2F. In addition, Mason states that this medium demands a higher energy level compared to F2F. This is due to the fact that the teacher needs to not only concentrate on the context but on the visual and oral dynamics, as well as the students both on and off campus. Consequential to this demand, there is an increase in a teacher's stress level.

At the beginning of each lecture session, there needs to be an acknowledgement of the nonlocal students as this enables the lecturer to present a personal touch and recognition to the nonlocal students. Switching campuses for delivery is also a desirable feature to engage students, develop a rapport, affect student learning and their motivations.

Ramsden (1992) outlines that students should be active learners so as to make information meaningful to themselves. Video conferencing encourages passiveness at the non-local site (Childs and Nicholls (2003)). Therefore, it is difficult to retain attention of students during lectures. Non-local lecturers are not fully aware of the off-campus situation, student understanding and responsiveness during the delivery of lectures. Childs and Nicholls suggested that an effective teaching practice is to break down the lectures into shorter segments with activities away from the screen that can be discussed/shared later. For instance, giving the opportunity for students to present their own work is a way to improve this situation.

The non-local learner is compelled to assume a large degree of autonomy that could be uncomfortable – Noss and Pachler (1999). The on campus lecturer is compelled to assume an increased supporting, helping role. Hence, there is a heavy reliance on the local tutor to fill the gaps and help in the learning outcomes. For instance, in one particular flexible delivered subject, the local tutor currently goes through the lecture notes with the students, this seems to be contrary to what the tutor is assigned to do.

### **(b) Behavioural Management**

One of the most important aspects of gaining a rapport with the non-local students is to be able to meet face to face. Cochrane (2000) suggests that there should be a least 3 visits to the off-campus site(s).

The crucial visit should be done at the beginning of the lecture session. It is anticipated from this meeting that there will be a rapport between the academic and students. This will relax and help engage the students, enhance their interaction and forthrightness during question time especially when students have content delivery problems.

Notwithstanding, the 'up-the back' students in lectures are always in visual sight of the lecturer. During flexible delivery, lecturers should also be aware of students that sit out-of-camera range at the off-campus. These students are called 'VC lurkers' (Cochrane, 2000). During F2F these non-active 'up-the back' participants can be identified. This can be dealt with by having a 1 to 1 communication with the student(s) to encourage or urge their participation. However, this is not easily obtainable in video conferencing.

The ability to switch off or mute video conferencing should ring alarm bells to the academic/lecturer. Switching off or muting, should be seen as a class withdrawal and a voice of frustration by the students. This is assuming that the lecturer actually is aware of the muting or any issues relating to the subject and its delivery. It is too late when student evaluations are done.

Most students have developed learning skills and learn in a face to face classroom situation and respond, in that environment (Seimens (2006)). Noise level at the off-campus site can be and is an issue with off-campus delivery, so much so that there is a need for human intervention, this is usually done by the off-campus facility manager or director.

### **(c) Tutor Intervention**

It is imperative with flexible delivery that the tutor is knowledgeable not only in the content of the subject but the needs of those students who are bound by distance education as their method of learning. Thus, a strong rapport is essential.

On the main campus, students can obtain help for only one hour per week. Nevertheless, in a flexible delivery situation there is a strong demand for more contact hours with the tutor. Notionally it is 2 hrs per week for fewer students. Although, for students who do not have immediate F2F contact with the lecturer, flexible delivery can be perceived, by both students and staff, as not delivering the right proportions for student learning. Thus extra hours of F2F are indeed considered necessary to give quality of education.

Strong communication links between the off-campus local tutor and the delivery lecturer is paramount for successful information dissemination. the tutor is a central go between for nonlocal students and lecturer to relay significant educational needs or problems, that may arise.

## **An early report on the implementation video conferencing**

A School decision was made that two mathematics subjects would be taught via video conferencing while delivering the same subjects on campus simultaneously. This decision was based on giving the students exposure to more full-time academics. In addition to this, the



decision was made under the pretense that there would be no perceived student difficulties, extra academic workload or change in lecturing style by the academics involved with the intended delivery.

Furthermore, it was anticipated that there was not a need to undergo any formal or informal training in the use of video conferencing, learning strategies, its facilities and capabilities. It was perceived by the School that video conferencing to an off-campus site was simply the same type of delivery as teaching face to face.

Consequently, lecturers realized that their 'usual' teaching style needed to be reviewed as presentations and dynamics did not fit with video conferencing. One lecturer's teaching style was to enhance student learning by building rapport. This was done in a style that involved the disseminating of information, 'doing' an example then allowing the students to try an exercise themselves. Whilst students are active in 'doing' their example the lecturer would walk around the room (even in large lecture theatres) to encourage, to help, to allow 1 to 1 questioning and to promote student centred learning. This style is not compatible for video conferencing.

This preliminary report was undertaken with 3rd year Mathematics students from a cohort of undergraduate pre-service secondary school teachers from the University of Wollongong. Students were enrolled in a third year mathematics class that is a core subject for the Bachelor of Mathematics Education offered by the Faculty of Education at a satellite campus. They are familiar with the concepts of teaching and delivery of subject matter through their own subjects. These students at the off-campus site had been familiar with face-to-face teaching for, at least, 3 years of their degree, as well as, participated in small class learning and were quite comfortable and confident in asking questions in this format.

From the outset of video conferencing, it became quite apparent that students were discontented with this style of presentation. Students felt alienated. This may have been due to the fact that there was no previous introduction or personal contact with the lecturer prior to the subject content being delivered and therefore no relationship between them and the lecturer along with the student cohort at the main campus. In turn, this created stress/tension amongst the students together with the perception that the 300 level mathematics subject was 'harder' which was further exemplified due to video conferencing. Furthermore, they felt that they needed to retrain their learning habits because of the different medium (just like they had to do when they were in first year).

One student chose to travel to the main campus to obtain the F2F delivery.

Students complained about not being able to see the lecturer as the size of the lecturer's picture is very limited on their screen. Derived from the student's television/dvd experiences, the 2D visualization of video conferencing intends that visual and sound dynamics be offset for the lack of 3D exposure and experiences. Thus from the students point of view this was not apparent during the video conferencing and became a 'turn-off' situation. The stimulus is not there and therefore student have a greater tendency to switch-off or dis-engage in their learning activity at a greater rate than they experienced with F2F teaching.



Notwithstanding, the smartboard was not able to be used due to associated technical problems. However, for smartboard presentations, students need to feel comfortable and non-threatened. The major apparent reasons are lack the confidence due to their mathematical inabilities and also presentations to an unfamiliar class of students (even at a distance).

Students also felt that they were not part of the learning process. Ownership of the subject was still with the lecturer. However, students' ownership of the subject is the final process/outcome in student learning. Creating an atmosphere by the lecturer to make a student feel that they are teaching them is an 'art form'. If this is not in place then a student could feel dis-engaged and alienated. Depending on the teaching style, a lecturer could focus on the large body of students with their F2F lecture and mostly neglect the off-campus students.

During F2F, students had the chance to focus on peer to peer help to clarify certain points usually with acknowledgement of the onsite lecturer. Video conferencing does not allow for this situation. Due to their alienation and inhibitions regarding the medium, it was stated by the nonlocal students that they were not confident enough to stop the lecturer to ask questions and/or state they could not understand a piece of information on a particular slide usually earlier in the presentation. As a result, the quality of and demand on the local tutor is increased to help replace the lack of F2F at the off-campus site.

At present, off-campus students are required to enrol in their next session subjects. Their first question was 'which subjects will be video conferenced?' Their initial experience and exposure to video conference has been damaged. This negative affect has brought about the students' subjects selection on the mode of delivery over and above the issues that include that content, choosing of on-campus subjects that will inhibit their studies due to their intended 2 week practicum and the consequential requirement of having to travel to the main campus costing money and time. This is contrary to why the degree program was implemented for at the off-campus site.

Finally, from further observations at a satellite campus: There are strong indications in a non-mathematics subject that there are issues with the use of video conferencing. It has been observed that a small number of students were 'turning-up' to the video conferencing lectures, compared to the tutorial whereby the room was full. The lecturer and local would not be aware of this is dynamical situation as both are not present at each other's contact hours and therefore make a conclusion.

In another non-mathematics subject, the local tutor has been employed for 3 hours. The 3rd hour is currently being used to revise lecture notes with the satellite site students. This emerges to defeat the purpose of remote delivery of lectures and strongly suggests that this type of medium is not working and/or the lecturing style is not conducive for the medium.

## Summary

With regard to Cochrane's research into video conferencing, he states that "It is naive to assume that merely linking distant groups or individuals at different locations creates an effective learning environment" Cochrane (1996, p320). Thus, video conferencing has its place when F2F is not an available choice or is used to enhance the teaching and learning of students.

With the improvements in technology it has blurred the differences between F2F and 2D deliveries. We are tactile animals. Students learn and are educated through 1 to 1 or 3D communication. Importantly, it involves expressions and communication that are not confined to a particular square, box or cyber medium.

Not all lecturers are suited to give video conferencing lectures and the number of students will affect the mood of delivery. Some may find it easy to adapt their style of teaching. Lecturers should be given the choice if they wish to participate in using this type of technology. More importantly, video conferencing should not be considered in the same way as teaching in a F2F situation.

Humans are relationship builders requiring the medium to be one to one. They need ownership and positively develop in a medium of face to face.

It should be mentioned that:

- (a) Lecturers have ownership of subject and its content.
- (b) Students and lecturers need a relationship to build confidence and rapport.
- (c) A good teaching environment is interface! Thus the superior medium of delivery and good teaching and learning practices!
- (d) From this relationship students value, learn and take ownership of the subject content encouraged by the lecturer's teaching practices.

Flexible delivery should be used to enhance the power of F2F rather than being a replacement by technology for technology sake.

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