“REACT Overcomes the Challenges In Distance Education”

REACT®
Remote Education And Conferencing Tool
Version 4.0

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Introduction

Educating people in remote and regional locations is challenging for the students, their families and their teachers not to mention their education departments and institutions and it is challenging for many reasons. Reasons often cited include geographical distance, pedagogy constraints, feeling isolated from other learners and teachers, cost-effectiveness and a lack of suitable infrastructure.

The directors of M & S Consultants Pty Ltd, Michael and Suzanne Wilson have lived and worked in remote locations in northern Australia and as a result, have first-hand knowledge of the challenges of living, working and studying in remote locations.

They were frustrated by the lack of quality communications infrastructure and found effective and efficient education, training and video-conferencing impossible to access for those living in remote locations.

They found a significant need for a new generation of remote communications which would take advantage of new technologies to shorten the perceived transactional distances between people and to provide an intuitive, flexible and cost-effective way of delivering education, training and video-conferencing. Finding a lack of a suitable solution, Michael and Suzanne set about developing one.

This document describes the solution and explains how many of the challenges are overcome and covers three key areas: technology, pedagogy and sustainability. Whilst the challenges discussed in this document are not exhaustive, they do form a substantial proportion of the more common issues found in distance education.
REACT in the Beginning

The program was launched onto the market late in 2005 when M & S Consultants Pty Ltd were successful in winning the Northern Territory Department of Employment, Education & Training's (NTDEET) tender to provide the Schools of the Air with the software to enable Interactive Distance Learning (IDL) lessons to be delivered from the Schools.

Using REACT, school students in remote and regional areas of the Northern Territory (NT) have been participating in educational IDL lessons through the Schools of the Air - arguably the largest classroom in the world, for the past eight years.

The teachers at the Schools of the Air were also the first to use REACT for its video-conferencing capabilities engaging in staff meetings, parent & teacher interviews and school council meetings.

Following the overwhelming success of the first year of REACT's deployment, the NTDEET (now NTDET) expanded its use of REACT to remote, regional and urban schools. Virtual schools were established providing the opportunity for teachers in specialist subjects in any school to deliver lessons to students throughout the NT irrespective of geographic location. Languages, music and science subjects are currently delivered to secondary school students throughout the NT.

Seeing the opportunity to be able to conduct and participate in meetings from the comfort of their own desks, the NTDET also adopted the software for use for their corporate video-conferencing.

The popularity and success of REACT as an IDL and video-conferencing solution saw the contract with NTDET extended several times.
REACT Today

REACT has stolen a march on its competitors by not only providing a synchronous, real-time IDL solution that provides a rich and engaging experience for its users but has done so by working collaboratively with the software users to maximise its potential. No other software provider is prepared to tailor a program to meet the needs of its clients or is prepared to work with the client to maximise the capabilities of their existing communications networks.

As a result, currently in late 2013 REACT is servicing distance education and video-conferencing needs nationally and internationally. In addition to the NTDET, clients include:

- NSW (Australia) Department of Education – distance education schools
- Ministry of Education Fiji – secondary school studies
- University of the South Pacific – adult education across 13 South Pacific island country campuses

In addition, a number of other organisations use REACT for specific purposes and they include:

- Royal Institute for Deaf & Blind Children – schools education for special needs students
- Alice Springs Language Centre – language education for school students
- Richmond Football Club – mentoring indigenous youth

The success of the innovative technology, the pedagogical integrity of the software and its sustainability for the long term future of DE cannot be argued with, given its success today.
What is REACT?

REACT is a multi-party, multi-session, multimedia collaborative software program and is designed for delivery of real-time synchronous Interactive Distance Learning (IDL) lessons and video-conferencing.

The software provides an exciting, interactive program providing multiple 2-way audio and video of the highest quality. In addition to the audio and video, REACT provides a range of rich, innovative and flexible multimedia collaborative tools including:

- Collaborative Storyboard
- PowerPoint
- Chat
- Whiteboard & inking
- Inserting screenshots
- Desktop sharing
- Application sharing
- Internet browser sharing
- Playing windows media files
- File transfers

Combining the capabilities for use in one form provides an intuitive, easy and flexible way in which to participate in a lesson and enhances the interaction between teachers and students but just as importantly, between the students themselves.

REACT also provides a wide range of recording and playback features from a simple screen grab through to the full recording and playback of entire lessons.

The software operates over both terrestrial and satellite networks but is optimised for use over satellite which is often the basis for remote communications.

Further information exploring the capabilities in detail is available in the “Introduction to REACT” PowerPoint available on the REACT website at: www.react-live.com
The Challenges

As mentioned in the introduction, educating people in remote and regional locations is very challenging. The reasons discussed in this section are drawn from research, knowledge base and discussions with those involved in distance education (DE) including teachers, students and education managers.

Technology

- Until recently, DE in much of Australia has meant the use of HF radio using often unreliable and poor quality audio which provided only an auditory means of delivering a lesson. In the absence of HF radio, correspondence was the only option for DE.

- Satellite infrastructure is often the means for remote communications, although terrestrial communications are slowly expanding into this area and are often available in regional areas. Satellite (and terrestrial) networks require the necessary infrastructure to be in place and this is seen to be very expensive and requiring large investments in money, materials and labour to maintain it.

- Bandwidth used to carry the data is very expensive and often prohibitive to smaller educational institutions.

- Not only are satellite and/or terrestrial networks required, specialised computer hardware to run software programs are required to enable delivery of lessons to students. These also necessitate specialised ICT knowledge to maintain.

- With the rapid advances in technology even after investment of specialised computer hardware, users are quickly left with outdated and inefficient technology.

So the challenge becomes: How to find a cost-effective and technologically advanced whole system solution?
Pedagogy

- The first challenge is that there are two modes of DE whereby participants are usually separated by distance and/or time.
  - **Synchronous**: This describes learning activities in which the students and teachers are separated by distance, but not by time e.g. HF radio.
  - **Asynchronous**: This describes learning activities in which the students and teachers participate at different times e.g. correspondence.

Both school age and adult learners will have studied in one or the other or a combination of modes. However, whilst adult learners may succeed with online or external studies (asynchronous), research shows significantly higher drop-out rates for online rather than on-campus students.

- In a study of MBA students at East Carolina University in the US, online MBA students’ attrition rate was 6 or 7 times higher than for on-campus students. (1)

- Secondly, studies have also shown that the importance of interaction is a strong influence on knowledge retention. The Cone of Learning Chart below highlights the importance of giving students an active role in the learning process.

![Cone of Learning](image)

**Figure 1 - Cone of Learning** (2)
From the chart above, it is evident that having students actively involved, by participating in discussions and activities, their expected level of retention will increase anything from 10% to 90%! These figures have been confirmed through studies at North Carolina State University and Digital Equipment Corporation.

- Teachers may be intimidated by new technology and reluctant to adopt it especially where they are time constrained to learn the new technology.

- Teachers may be concerned that they will not be able to readily transfer curriculum content already developed to the new technology and again especially where they are time constrained.

The challenge here is: How can we provide DE that is synchronous and as engaging as possible to give students the greatest opportunity to succeed and to mitigate attrition rates?
**Sustainability**

The core of mainstream sustainability thinking has become the idea of three dimensions, environmental, social and economic stability. These have been drawn in a variety of ways, as ‘pillars’, as concentric circles or as interlocking circles as shown below.

![Sustainability Diagram](image)

**Figure 2 - Sustainability**

- The challenges in providing DE in a sustainable manner have been considerable in the past as DE is usually resource intensive.

  - Environmentally, whether it has been the endless use of paper or the use of extensive communications infrastructure, DE has had a huge impact on the environment.
  
  - Economically, the huge resources requirement in people, time and infrastructure to name but a few, has placed considerable burden on DE institutions.
  
  - Socially, extensive research has shown that those studying in remote and regional locations find it difficult to form a ‘sense of community’ with their peers and teachers so that they do not feel removed from activities or are working alone.

The challenge ahead is: How to find a method of DE delivery that not only overcomes the challenges above but is bearable, equitable and viable to ensure its sustainability not only in the short-term but for the long-term?
Overcoming the Challenges

As discussed previously, the challenges in DE can be daunting and difficult to overcome. The design and development of REACT was founded on the understanding of these challenges with every technique employed to overcome them. Again we look at the three areas of technology, pedagogy and sustainability:

Technology

Capabilities

- REACT provides a fully interactive and collaborative software program over which IDL lessons can be conducted. The program has been used by the Schools of the Air in the NT for the past eight years. In 2006, Katherine School of the Air turned off their HF radio for the last time welcoming in a new era of face-to-face classrooms.

- Using the latest advances in technology, REACT provides multiple 2-way video and audio of the highest quality which enables all participants to not only see and hear the teacher but to see and hear their classmates also. The software does not limit the number of video and audios than can be streamed simultaneously providing participants with an engaging face-to-face experience.

- REACT also provides a simple and clear solution to recording content and sessions and making these recordings available to users at a later time.

- The number of classrooms or meeting rooms (venues) which can be created to run simultaneous lessons with access to all capabilities is unlimited. This provides flexibility in scheduling of lessons and meetings. Users access to venues is controlled through the login process to ensure only bona-fide participants enter any given venue ensuring security for all participants.

Hardware & Software

- Users have the option of setting up dedicated IDL studios much like a TV studio from which lessons are delivered. The Schools of the Air in the NT have several studios set up and dedicated to lesson delivery of all subjects. Lessons can also be delivered from and to school classrooms or from teachers’ desks using simple laptops, webcams and microphones.

- The flexibility of being able to use a laptop provides teachers with the opportunity to deliver lessons from almost any location. Students can also receive lessons in this manner so can participate from their homes, schools or workplaces.
➢ REACT operates on standard everyday computers whether they are desk-top models or laptops using simple webcams and microphones. This eliminates the need for expensive specialised hardware and minimises the risk of being left with obsolete and inefficient computer hardware. However, where a larger budget permits, clients have the option to use high end computers and peripherals if so desired.

➢ REACT is scalable which enables capabilities such as video quality resolution and compression rates to easily and quickly be configured enabling efficient use of bandwidth.

➢ Installing the software is also easy to do and can be downloaded from the REACT website with only a few clicks of the mouse. Installation takes less than 30 seconds and takes up only 5.5Mb of disk space.

➢ Using everyday computer hardware and peripherals together with easy installation means that maintenance by the schools’ ICT department is routine and does not require specialist knowledge.

➢ Training is provided initially for all client ICT personnel to assist with integration into the educational environment with assistance in the set-up of studios and classrooms.

➢ M & S Consultants Pty Ltd offers on-going support and maintenance to all REACT clients to ensure total client satisfaction.

**Network**

➢ REACT utilises multicast rather than unicast network communication. Multicast is a technique for one-to-many communication over an IP infrastructure in a network. It is extremely efficient in that one stream of data can be broadcast and viewed by one or thousands such as is found with television for example. This provides efficient use of bandwidth. If unicast were used, the stream of data must be sent individually to every viewer making it highly consumptive of bandwidth. As bandwidth is generally very expensive, the use of multicast makes it a very cost-effective means of reaching many users.

➢ REACT uses Peer 2 Peer (P2P) architecture which eliminates the need for a central server, possible network bottlenecks and associated delays ensuring continuity of service.

➢ Designed to be used over a variety of communication transports, REACT is optimised for operation over satellite infrastructure which is often the basis for remote communications. REACT has been proven to work over satellite, ADSL and MPLS Wide Area Networks and can be tailored to operate over most network architectures.
**Pedagogy**

**Mode of Delivery**

- REACT is a synchronous method of lesson delivery and is designed to operate in real-time whereby a teacher delivers a lesson from a studio, classroom or from their desk. Regional and remote students log into the lesson from their chosen location and participate in much the same away as a conventional classroom.

- Any number of classrooms or meeting rooms (venues) can be created to run simultaneous sessions with full access to all capabilities. Users access to venues is controlled through the login process to ensure only bona-fide participants enter any given venue ensuring security for all participants.

- All participants have equal opportunity of access to use the capabilities whilst the control of these remains with the teacher. As an example, not only can the teacher stream their video or share their desktops, all students can share theirs also so that all participants see and hear everything in real-time.

- REACT also provides a simple and clear solution to recording sessions and making these recordings available to users at a later time. The ability to capture lesson components provides resources for future use and also provides a means of assessment of student participation and contribution.

- In most cases, very little or no modification of existing teaching materials is required as these are usually transferrable.

- REACT extends the reach of teachers in specialist subjects (which are often difficult to source) to any student wherever they may be located geographically. This increases the scope for student education and provides resource and cost-effective solutions to educational institutions.

**Engagement**

- To ensure that REACT is as engaging to participants as possible, it is designed to be interactive and collaborative with a wide range of capabilities at the fingertips of the participants. Utilising a range of rich multimedia tools has proven to be very effective in engaging students of all ages and capabilities and not only expands their horizons but also empowers them to become educational explorers.

- Previously students had no way of knowing who their classmates were – unthinkable in the urban classroom. REACT provides the tools to transport them from their ‘solitary confinement’, which is not only empowering but ‘shrinks’ the perceived transactional distance between them.
Within the software, students and teachers can create their own personal profile comprising an image (photo or clipart) and their ‘friendly name’ that the participant wishes to be known by. This profile is shown in a class attendance window for all participants to see. This can be changed as often as desired and has been proven to be a catalyst for ‘show and tell’ across the miles.

**Technology Adoption**

Learning how to use a new technology can be daunting to some and with this in mind REACT is designed using principles of interaction design which is the foundation for designing graphical user interfaces (GUIs). This makes it easy and intuitive to use and maximises the user efficiency. Initial training is provided to teachers with follow up training where required. However, the software is so simple to use that even pre-schoolers easily adopt the technology.
**Sustainability**

**Environmental**

- Whilst technology is renowned for being ever-changing and ever-improving, REACT operates on standard everyday computers whether they are desk-top models or laptops using simple webcams and microphones. This eliminates the need for expensive specialised hardware and minimises redundancy of computer hardware.

- Whilst REACT is optimised for operation over satellite infrastructure, it can be tailored to operate over most network architectures and can bridge existing video-conferencing equipment. This eliminates the need for new network infrastructure and reduces redundancy of equipment.

- The use of multicast technology efficiently and effectively reduces the resource intensive bandwidth consumption found with software solutions utilising unicast technology.

- As REACT provides a rich and engaging learning environment including the use of 2-way video, the necessity to travel to ‘see’ students and colleagues is significantly reduced. This reduces the carbon footprint as far as the consumption of fuels and their emission are concerned and reduces the need for vehicles and their non-environmentally friendly servicing.

- Using REACT, lessons can be delivered in real-time significantly reducing the need for correspondence education materials. Teachers and students can transfer files such as study materials and assignments electronically, using the ‘file transfer’ capability within REACT. These files can also be stored electronically and only need to be printed out as required.

- In addition, the ability for teachers to record, edit and replay their lessons provides resources that are re-usable time and time again.

**Economic**

- REACT is designed to be cost-effective in that users can choose to deliver lessons from a dedicated studio, a classroom or from a personal computer, dependent on their budget.

- The utilisation of multicast technology rather than unicast makes delivery of lessons using REACT extremely efficient in its use of bandwidth which provides an enormous cost saving to educational institutions.
Also providing for efficient use of bandwidth, capabilities are scalable e.g. video quality resolution and compression rates can be easily and quickly configured to suit the bandwidth available.

As REACT operates on standard everyday computers whether they are desktop models or laptops using simple webcams and microphones, the need for expensive specialised hardware is eliminated. This also minimises the risk of being left with obsolete and inefficient computer hardware which is wasteful on resources whether environmental or economic.

Using everyday computer hardware and peripherals together with easy installation means that maintenance by the schools’ ICT department is routine and does not require specialist knowledge. This maximises the use of existing IT resources and minimises financial expenditure.

With the software providing fully interactive and collaborative capabilities as well as 2-way video and audio, the need to travel to ‘see’ students is minimised saving valuable resources in people, time and travel to name but a few.

The ability for one specialist teacher to delivery lessons to any number of geographically dispersed students at any one time provides an extremely efficient use of teachers as a resource.

REACT’s pricing model makes it affordable for educational institutions of all sizes.

Social

REACT incorporates a number of features which are designed specifically to increase the social presence between students, teachers, parents and community members. This is essential to help form a Sense of Community for those living, working and studying in regional and remote locations.

The ability for participants to create their own personal profile comprising an image and their ‘friendly name’ provides a unique insight into the personality of the participant which is shared with all the participants in a venue. This has been proven to be a catalyst for many interactions which help to form social bonds.

The use of multiple 2-way video and audio provides an excellent means of providing a social interaction. Students can chat as they would in any schoolroom and with the use of video and a simple webcam can see into the lives of other students. Teachers often permit students to have free conversation before or after a class just as they would in any school yard or campus.

Fully interactive and collaborative capabilities provide opportunities to increase social interaction which are limited only by participant’s imaginations.
Teachers, parents, community groups and school councils can utilise the software and hold virtual meetings without leaving their desks or homes providing an excellent foundation for social interaction and relationship building.

**Viable, Equitable and Bearable**

In addition to being environmentally, economically and socially sound, REACT is also proven to be viable, equitable and bearable by overcoming other challenges as listed below:

- Students that live and work in regional and remote locations deserve to be treated as equitably as their urban counterparts.

- Educational institutions need to provide students and teachers with educational solutions that not only meet their DE needs but also provide an engaging experience to give their students the greatest chance to succeed.

- DE solutions also need to provide the foundations for a socially engaging environment to enable a healthy ‘sense of community’ to be formed.

- Educational institutions need to demonstrate that they are environmentally accountable and employ sound economic practice when making investments within a limited budget.
Conclusion

Overcoming the challenges faced by DE providers is not an easy task, however as has been evidenced in this document, REACT provides a carefully designed and developed cost-effective and technologically advanced whole system solution.

A solution that has all the benefits of synchronous DE and has proven to be engaging to students giving them the greatest opportunity to succeed whilst at the same time minimizing attrition rates to the benefit of educational institutions.

The sustainability of the software cannot be denied as has been evidenced by its continued up-take by educational institutions and its on-going role as the software of choice for DE in the NTDET.

M & S Consultants Pty Ltd constantly strive to make REACT the solution that clients want and need and work collaboratively with clients to ensure this.

The solution is designed and developed using the latest advances in technology and will continue to take advantage of these to ensure REACT stays at the leading edge of design and delivery of distance education.
Awards

Consensus Software Awards 2006
M & S Consultants is the winner of the prestigious national Consensus Software Awards in 2006.

Judge’s Citation

"Remote Education and Conferencing Tool (REACT) demonstrates excellence in the application of technology to provide a fully engaged communications experience. REACT demonstrated clear innovation in applying multicast and satellite technology to create a fully interactive remote classroom. The control for teachers and presenters to control the focus and full classroom interaction provide a complete remote classroom experience. The application of this core technology to other collaboration modes ensures a great potential for REACT."


NT Information & Communications Technology Award 2005
M & S Consultants is the winner of the NT Information & Communications Technology Award in the category of Enabling Technology in 2005.

Award Extract

“The REACT system was developed to specifically meet the needs of teachers, students and parents in the challenging environment of distance education. The software provides the tools to permit the development of a Sense of Community through a range of flexible capabilities now at the fingertips of teachers. This will provide teachers and students with learning options limited only by their imagination.”

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