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On-line teaching and learning: Australia-Poland

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ABSTRACT: On-line teaching and learning have become an everyday reality. The article provides an assessment of fully on-line course(s) delivered from Australia to Polish students at Lublin University of Technology, Lublin, Poland, in an on-line learning environment. Advantages and limitations of applied tools for on-line teaching/learning are outlined leading to recommendations for future developments. Student feedback on the Diploma Seminar course, in the final year of the Master's degree in information technology was very encouraging. Over 70% of the students agreed or strongly agreed (on a Likert-type scale) that two delivery modes: on-line and face-to-face demonstrate similar learning outcomes. Technical details of the Internet connection parameters, using Skype, are analysed and discussed. These are critical for delivering a quality education on-line in order to make available all media: text messaging, live voice and video presence, and recorded video. The overall experiences of the students and lecturers were clearly positive and will lead to further developments in on-line teaching and learning.

Keywords: On-line teaching and learning, engineering education, international education, remote laboratories

INTRODUCTION

On-line teaching and learning is increasingly common in educational institutions worldwide. At the University of South Australia (UniSA), 40% of students in 2014 completed some or all their degrees on-line [1], with some 20 degrees offered completely on-line.

Between 2014 and 2017, the authors of this article have been involved in the development and delivery of several courses at Lublin University of Technology (LUT) in Poland. The eight courses developed and implemented had over 220 students, ranging from Bachelor's, through Master's to PhD levels, both in stationary full-time F/T (daily) and correspondence, part-time P/T mode, have been involved in teaching/learning in an on-line mode or in a hybrid mode. Details are outlined in Table 1.

There are some accredited engineering Bachelor's and Master's degrees in telecommunications in Australia offered entirely on-line, including extensive laboratory components, using only remote laboratory approaches [2]. The national Australian accrediting body - Tertiary Education Quality and Standards Agency (TEQSA) was quite anxious about whether this unprecedented practice in engineering education would match the real laboratories, but it has been determined that this approach can deliver comparable learning outcomes.

In the article, the authors discuss teaching and learning experiences of staff and students involved with teaching from to Australia to Poland, together with course evaluation results. Advantages and limitations of applied tools for on-line teaching/learning are outlined leading to recommendations for future developments.

Technical details of the Internet connection parameters, using Skype, are analysed and discussed. These are critical to deliver a quality education on-line.

TEACHING IN POLAND FROM AUSTRALIA

The lead author of the article has been involved in teaching at LUT for many years since his migration to Australia in 1992. The links to his *alma mater* have been active and resulted in many teaching assignments at LUT for the past 25 years. In 2014, LUT has expressed willingness for him to be involved in LTU teaching on a more regular basis. It could

also benefit the budget of the Faculty of Electrical Engineering and Computer Science at LUT (subsidy from the Ministry of Science and Higher Education of Poland) by employing a *foreign professor*. This has been an attempt to internationalise Polish university education by employing professors from abroad, to expose Polish students to international academic environments and prepare graduates for global employment opportunities. The subjects/courses taught in the period 2014-2017 are listed in Table 1.

Table 1: Teaching details for students at LUT (P/T - part time, F/T - full time).

No	Year	Programme	Course	Student numbers
1	2014	PhD, 1st year, P/T	Information Technology	20
2		MEng, 2nd year, P/T	Monographic Lecture on Remote Laboratories	29
3	2015	PhD, 2nd year, P/T	Engineering Applications of IT	20
4		PhD, 2nd year, P/T	Information Technology	20
5		BEng, 4th year	Diploma Seminar	28
6	2016	PhD, 2nd year, P/T	Modern Techniques of Teaching Delivery	27
7			Scientific-Technical English	20
8		PhD, 1st year, P/T	IT Tools in Scientific Research	15
9	2017	PhD, 1st year, P/T	IT Tools in Scientific Research	15
10			Preparation of Scientific Articles and Presentations	15
11		MEng, final year, F/T	Diploma Seminar	15
12	2014-2017	BEng to PhD levels	8 courses developed and delivered	224

TECHNOLOGY USED

The tools utilised were Skype, Moodle (at LUT, as a repository of teaching/learning resources and useful links), email and the remote laboratory NetLab [3], along with modelling and simulation instruments: MATLAB, Simulink, LabVIEW and SPICE.

Skype has been the major communication tool, enabling a duplex verbal and video communication, and also allowing lecturers and students to share screens, using Skype menu call/share screens (Figure 2). The Polish students could see the lecturer and his computer screen. The lecturer could see the audience and their laptop screen and/or a projector screen.

The Internet connection quality was a major factor in exchanging videos, images and sounds. As long it was of the quality shown in Figure 1, things went well.

The important parameters of the Skype connections are: *roundtrip* - the latency of the network connection between the call participants; if between 150 ms and 200 ms, is excellent, but the one shown in Figure 1, is 44 ms. This means that the participants on both sides of the connection can speak in almost real time without a noticeable time delay. *Relays*, which were 0 meant that there were no drop-offs between the several routed nodes. *Jitter* illustrates the variations between consecutive data packets arriving at the user's side. 62 is a very good result. *Packet loss* measures the reliability of the connection. Again, 0 is excellent [4].

The Internet speed, measured by Speedtest.net [5] gives a figure of 33.7 Mbps download and 1 Mbps upload. This is in contrast with Skype parameters in Figure 1, upload speed 85 kBps and download speed 63 kBps. It is necessary to emphasise that results from the Speedtest.net above were obtained with Virtual Private Network (VPN) switched off. If VPN (in this case PureVPN) is switched on, the results are 13.4 Mbps and 0.93 Mbps, respectively.

In Figure 2, which illustrates a lecturer's screen, a much worse connection is pictured (down and upload speeds are less than 1 kBps). The cable connection box used on the Australian side is regularly flooded during rain fall. This could be the reason for the lower connection speed, prohibiting playing videos on both sides.

The audio was not working on the receiving side (it was working on the sending end), when videos (webinars and the like) were played, either from Australia or from Poland, although video images were visible in both cases. An immediate

remedy for that was to stop the video playout (to enable voice communication) and to reiterate the main points of the presentation, then, to repeat it with the following sequences of the video.

The connection speed sometimes varies on the Australian side from day to day, due to the above-mentioned vulnerability of the cable connection. Therefore, intervention of the Internet provider (Telstra in this case) will be required to reduce the connection impedance in the cable box.

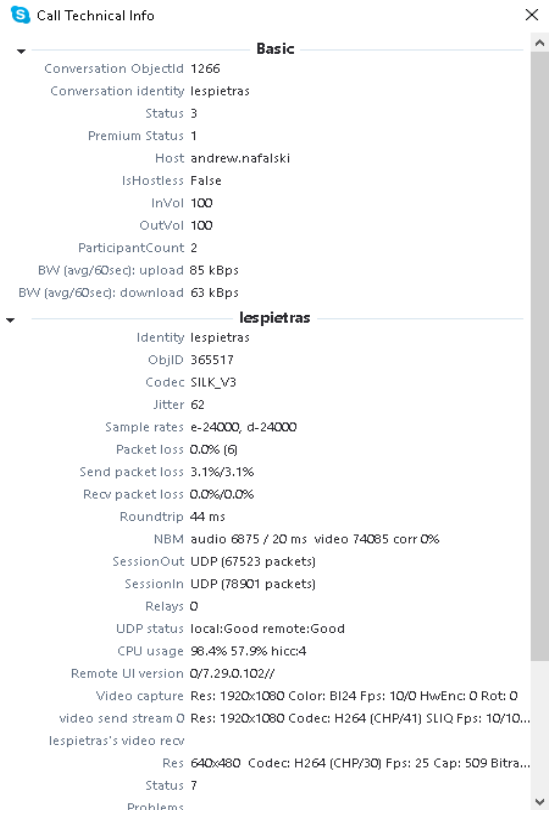

Figure 1: A good connection - call technical info from the Skype call menu.

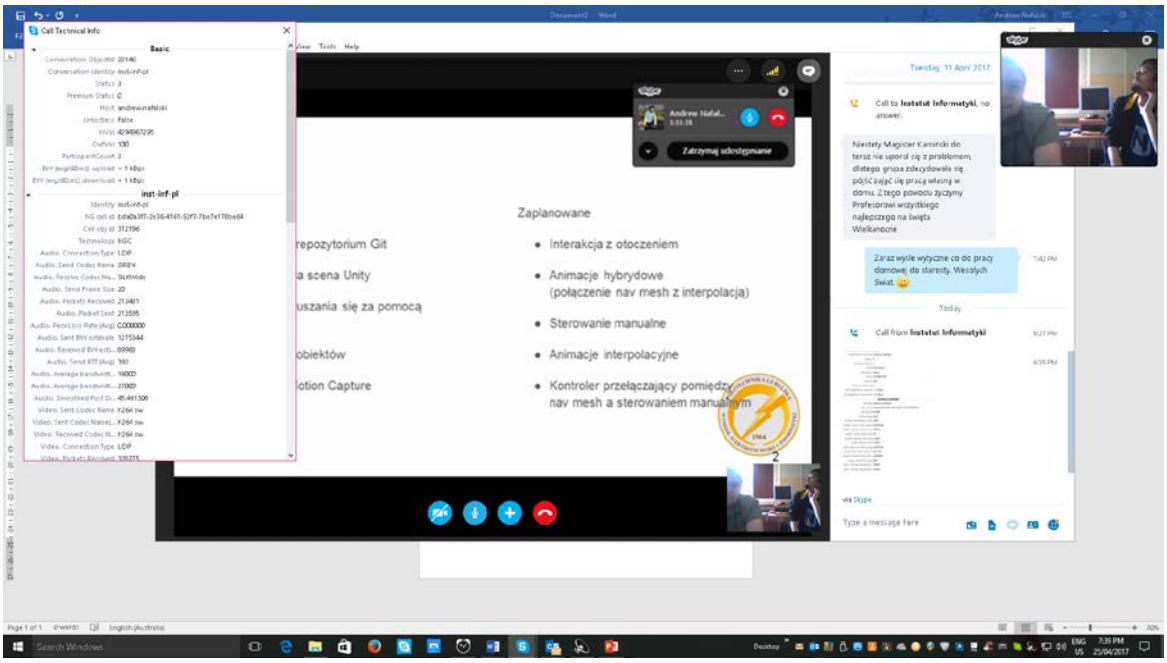

Figure 2: Lecturer's view. Visible are: a student's presentation (centre), Skype text dialog (right), the classroom (upper right) and the call technical info (upper left).

STUDENT FEEDBACK

In years 2014-2016, a hybrid teaching technique was used, combining face-to-face delivery in Poland and on-line teaching from Australia. This involved return travel of the lecturer from Australia to Poland for teaching, sometimes

twice a year, usually combined with attendance at some conferences in Europe. Accommodation was secured in Lublin in guest apartments at LUT. This hybrid approach has proved to be relatively expensive and logistically demanding. Therefore, in 2017, a purely on-line teaching/learning approach was adopted and executed, to see the impact of the exclusively on-line delivery. Three courses (items 9-11 in Table 1) have been delivered in that mode.

Figure 3: Photo of the classroom. Student's presentation on the screen. Lecturer's live video (lower-right corner of the projector screen).

In Figure 3, the classrom photo is shown with a lecturer's live video. This was emphasised in the student evaluation as important for the learning process.

Student feedback in 2017 on eight quantitative questions (item 11 in Table 1, final year of a Master's degree in IT, Internet applications) is presented in Appendix 1. In agreement with the Bologna process [6], the BEng degree is 3.5 years long and the follow up MEng degree is 1.5-year long. This is different compared with the previous structure of a 4-year BEng and a 5-year MEng programmes in Poland prior to 1999. The Polish 5-year Master degree was not recognised by Engineers Australia as a Master's degree, as it was a first degree programme, and as such was treated only as a BEng degree.

The Diploma Seminar course was delivered in ten 3-hour sessions between February and May 2017. Satisfaction with the course and with the lecturer are highly rewarding (Appendix 1). What is quite extraordinary, is the acceptance by the students that teaching on-line is comparable with teaching face-to-face in terms of learning outcomes - it has attracted 72.7% of agree and strongly agree responses on the Likert scale. Over 90% of the students would take another course on-line, if they had the opportunity to do so. 91.9% of the students stated that seeing the face of the lecturer on their screen has a positive influence on their learning process. There are some lessons to learn in on-line teaching/learning environments.

Two qualitative questionnaire questions were answered (Appendix 1):

- Q9 - What are your positive experiences with taking the course completely on-line? It resulted in very interesting responses. A number of students felt that on-line presentations are less intimidating than in the face-to-face contact. They appreciated the exposure to different academic cultures, the international experience of the lecturer, his expertise, good motivational atmosphere in the class and more focus, leading to better attention during classes.

- Q10 - What can be realistically improved in the on-line course? This was another qualitative question. Internet connection quality was the foremost item mentioned. *Talk to students, not just lecture*, was another great point.

CONCLUSIONS

On-line course/subjects/programmes seem to be gaining momentum worldwide. This article reflects on on-line teaching from Australia of Polish students at Lublin University of Technology. The most important, and anticipated outcome of the student feedback is that on-line courses are comparable with face-to-face delivered courses in terms of learning outcomes.

Internet limitations are listed in the article, resulting in some dissatisfaction, but also the understanding of the participating students. Parameters of the Internet will be considered in future developments of on-line learning.

The assessment results of students who participated in 2017 in the delivery of three on-line courses were excellent for those who actively participated in the learning process. In case of PhD students (who have two years of coursework combined with research), the drop-off ratio was some 28%, which is not surprising, as the participants are full-time working individuals with family commitments. The ratio does not differ from previous years with the hybrid delivery mode.

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BIOGRAPHIES

Andrew Nafalski's career includes assignments in academic and research institutions in Poland, Austria, Wales, Germany, France, Japan, USA, Canada and Australia. He holds a BEng (Hons), GradDipEd, MEng, PhD and DSc degrees. He is an Adjunct Professor of Electrical and Information Engineering at the University of South Australia in Adelaide and a Visiting Professor at Lublin University of Technology, Poland. He is President of the International Academic Advisory Committee of the World Institute of Engineering and Technology Education. His major current research interests are related to innovative methods in engineering education, remote laboratories, learning analytics, electromagnetism, magnetic materials, electrical power and software engineering applications in electrical engineering. He has published nearly 400 scholarly peer refereed works in the above fields.

Hugh Considine completed a Bachelor of Software Engineering (Honours) at the University of South Australia in 2010, and a Bachelor of Engineering (Computer Systems) in 2014. He has worked on several short-term contracts in the areas of software engineering and electronic engineering, including some development work on NetLab. He has participated in several on-line course development programmes, and has been the tutor for a first year on-line electrical engineering course since 2012. He is currently undertaking a PhD in the area of remote laboratories. Hugh founded and continues to work with a team producing an open source programming tool for microcontroller programming.

Thomas Zawko earnt a Bachelor of Engineering (Honours) (Electrical and Mechatronic) at the University of South Australia in 2016. During this degree, Thomas was an active member of the university's Mechatronics Engineering and Robotics Club and contributed to projects, such as the National Instruments Autonomous Robotics Competition. Thomas has also completed short-term work experience placements related to electrical, electronic and software engineering. As of 2017, he is furthering his studies and pursuing a Masters in Electrical Power at the University of South Australia.

Zorica Nedic holds a PhD in engineering from the University of South Australia. Before her academic career at the University of South Australia, she spent six years working as an R&D engineer at the Institute Mihajlo Pupin in Belgrade, Serbia, after completing her BEng (Electronics) at the University of Belgrade. Her research interests focus on remote laboratories and technology applications in engineering education. She has authored and co-authored over 150 fully refereed publications.

APPENDIX 1

Evaluation of the Course:
Diploma Seminar

Master Programme IMST 3.2 AI, Final Year
Summer Semester 2016/2017

Faculty of Electrical Engineering and Computer Science

Lublin University of Technology, Lublin, Poland

(Please mark with X your choice)

No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Teaching on-line is comparable with teaching face-to-face in terms of learning outcomes	9.1%	63.6%	27.3%		
2	I am happy with the course assessment (50% project progress, 50% presentation for diploma examination)		72.7%	27.3%		
3	I am satisfied with the course	27.3%	54.5%	9.1%		
4	I am satisfied with the lecturer	90.9%	9.1%			
5	Seeing the lecturer on the screen has a positive influence on my learning process	36.4%	45.5%	18.1%		
6	If I have a chance I will take another course on-line	18.1%	72.8%	9.1%		
7	The course improved my English	9.1%	36.4%	27.3%	18.1%	
8	The demonstration of NetLab improved my understanding of the principle and operation of remote laboratories	18.1%	36.4%	36.4%	9.1%	
9	What are your positive experiences with taking the course completely on-line? *If not enough space, please write on the reverse*	For summary of responses, see the last section of Student Feedback				
10	What can be realistically improved in the on-line course? *If not enough space, please write on the reverse*	For summary of responses, see the last section of Student Feedback				