

2014

Using Innovative Tools to Teach Computer Application to Business Students - A Hawthorne Effect or Successful Implementation Here to Stay

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Khan, Z. R. (2014). Using Innovative Tools to Teach Computer Application to Business Students - A Hawthorne Effect or Successful Implementation Here to Stay. *Journal of University Teaching & Learning Practice*, 11(1). <https://doi.org/10.53761/1.11.1.6>

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This paper tests the continued success to establish whether the success recorded after the first implementation was sustainable or merely influenced by the Hawthorn effect of trialing an innovation. It concludes with final grade measure over a one-year period of implementation of the system, and student responses that strongly support the original approach used by the author.

Keywords

education, blended learning, guided discovery, hawthorne effect



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Introduction

I always tended to pay more attention to studies before a test when I knew Dad was watching and scored better in those tests than others.

– Peter Hitch, 22,
UOWD Graduate

Learning is a process that is meant to teach students concepts and skills, and eventually the ability to apply what they learn to life outside classrooms. However, educators around the globe seem at a loss for an answer to the dilemma of the right method of teaching that will ensure the right type of learning, particularly when teaching a subject from one stream to students in another. A number of factors, such as the language used, methods of teaching, pedagogical fit and the textbooks used, contribute to the success or failure of teaching a subject.

With the advancements of information communication technology, the impact on academia has been well-documented over the past decades (Bransford, et al. 1999; Hepp et al. 2004; Kozma 2005; Unwin 2009; Anderson 2009; Resta & Patru 2010), as have the ways in which these advancements have pushed learning beyond the classroom walls (Anderson 2010).

Some researchers have suggested that this technology has made teaching easier for academics in the 21st century, giving academics tools to enhance their teaching styles, strategies, communications and classroom environments (Collis 1999; Kozma & Anderson 2002; UNESCO 2010). In keeping with these studies, in January 2011 the author introduced a learning-management system coupled with guided discovery that allowed business students with little or no experience with computers to better understand computer applications; this project aimed to reduce failure rates for the subject (Khan 2011). While the results were highly satisfactory, with lower failure rates, in teaching computer applications to business students increased student engagement and overall student satisfaction, questions arose almost instantly regarding the long-term sustainability of the tools and pedagogy applied. Given that the results were based on only one semester's observations, they may have been influenced by the Hawthorne effect, in which people change their behaviour when they are under observation. The Hawthorne effect was first documented in 1955 when a researcher analysed data from a factory in Hawthorne to understand the impact of lighting levels within the building on workers' productivity, and concluded that the factory workers were more productive not because of the change in lighting but because they were being watched (Gale 2004).

Although much has been written for and against the Hawthorne effect, the purpose of this paper is not to confirm or refute it, but merely to establish the primary study's conclusions as sustainable. The purpose of the current study is to follow Shayer (1992) in revisiting the original study that was conducted in the spring semester of 2011 at the University of Wollongong in Dubai, and extrapolate it to three more semesters that together will comprise a control semester. The paper studies grades from classes taught by faculty members other than the author to test the results from the primary study. The current study also aimed to establish the long-term sustainability of using learning-management systems and guided discovery beyond the scope of a test environment to enhance the teaching of computer subjects to business students.

University of Wollongong in Dubai

The University of Wollongong in Dubai (UOWD) is a direct campus of the University of Wollongong in New South Wales, Australia. UOWD started 18 years ago in Dubai, a business hub of the United Arab Emirates (UAE). Due to its early entry into the higher-education market, the university systematically positioned itself as offering a Western education in the Gulf. It is also fully accredited by the Ministry of Higher Education and therefore is able to offer its graduates either an Australian degree or a UOWD degree, both of which are recognised in the UAE job market.

UOWD primarily offers two degree streams: computers and engineering, and business and finance. Currently it offers undergraduate, postgraduate and PhD programs in a host of degree majors for over 3,500 students from over 100 nations, on its campus at Dubai's Knowledge Village.

All undergraduate students, regardless of the degree they are pursuing, must comply with the accreditation policy in the UAE, which stipulates that they must enrol in general-education courses in their first semester. One of these required subjects is Computer Applications; it has an average class size each semester of over 100 students.

Teaching computer applications to business students

According to a study carried out by the Business Education Statewide Advisory Committee in California, USA, teaching computer-application subjects to students with non-computer-related backgrounds such as business creates problems because of the range of ability within the group. For this reason, the computer-applications teacher must be prepared to present material in a variety of ways, and to adjust to the students' knowledge of computers as well as their individual learning styles (BESAC 2011). UOWD instructors also face these circumstances. The author has been teaching the subject since 2006 and sometimes faces a class of over 300 students.

2.1.1 Student population and demography

Most of students in this subject – usually about 85% – are from either the Bachelor of Business Administration or the Bachelor of Commerce. Almost all are just out of high school, and range from 16 to 19 years old. They come having studied different school curricula, with varying levels of English (not as a first language) and different experiences of class-attendance policies and supervised learning.

2.1.2 Issues with teaching computer applications to business students

Earlier studies assert that because technology is often readily available to students at home, in libraries or on mobile devices, it has created a challenge for teachers because of the range of abilities and skills within the cohort (Khan 2011; Lundgren, Lundgren and Mundrake 1995). This is also true for students enrolling in the Computer Applications course at UOWD. Some students have very little exposure and experience while others may be creating their own apps for their mobile phones, making them immensely tech-savvy, although not necessary tech-aware (Lundgren et al. 1995).

Another issue is the subject itself. Computer Applications at UOWD covers the following topics:

- Application software
- Operating systems
- Central processing systems
- Input and output devices
- Storage and multimedia
- Networking and computer connectivity
- Internet
- Social computing

Students are also taught to use Word, Excel, Access, Front Page, PowerPoint and Movie Maker. Although the topics sound simple, students have often commented in subject evaluations that the depth of information is “overwhelming” or “too difficult”, that it “[makes] the subject less interesting” and that they are “not sure what it all means” (Office of Institutional Effectiveness 2007-2010).

As attendance is not compulsory in lectures, and as many students show low interest levels due to the difficulties posed by the depth of the subject or the English language barrier, the failure rate for the subject has been consistently high, at about 14% every semester (Subject Report 2007-2011).

Guided discovery and blended learning

Jerome Bruner (1967), John Dewey (1997), Jean Piaget (1954) and Lev Vygotsky (1978), suggest that discovery learning encourages students to become active participants in the learning process as they explore concepts and answer questions through experience. This student-centred practice covers an instructional model and strategies that focus on active, hands-on learning opportunities for students, as outlined by Dewey (1997) and Piaget (1954). It has become important to understand students’ minds, how they learn, what piques their curiosity, what catches their eye. According to Grantham in an overview of student learning: ‘learning is a change in [students’] conceptions – a change in [their] understanding’ it has been critical to understand that “students have their own way of learning, a ‘learning style’, and they will learn best when there is a variety of learning opportunities that give them their chance to learn in their own way” (Grantham 2005).

Based on the literature, and given the student demography and the issues arising from their varying backgrounds, the author decided to adopt guided-discovery practice to teach computer applications with technology integration, given the increase in the use of technology in students’ personal lives. The author chose to use teaching methods that would compete with those forms of entertainment that hold students' interest, such as Facebook (Khan & Samuel 2009).

There is also a perception that “Students never learn from technology per se; they learn from the strategies teachers use to communicate effectively through the technologies” (Singh and Reed 2003). This is true for all tools of learning. The author researched the practices across faculties, finding that the concept of blended learning has been in practice at UOWD for some time, with teachers using intranet websites, traditional classroom settings, textbooks, roleplay and other methods.

The author decided to apply blended learning by incorporating a learning-management system to the subject with several objectives:

- to increase student involvement with subject, peer and lecturer;
- to encourage independent learning in students, giving them flexibility in scheduling their studies and taking their assessments;
- to help students develop strategies to overcome language barriers; and
- to extend students' learning experiences beyond the traditional classroom and textbook reading.

4. Primary study

The original study (Khan 2011) had been carried out in the spring semester (January 2011-April 2011) at UOWD. The author used a learning-management system (LMS) to embed videos and set up online quizzes and student forums. The aim was to engage students with the subject, and draw their attention to the content through innovative learning strategies such as interaction in the forums. By using the LMS, the author managed to significantly reduce student-accessibility problems, as now students could access the notes and assessments and participate from anywhere and at any time.

The results highlighted the benefits of using an LMS (Khan 2011):

- the online tests helped increase frequency of tests and removed the need for student attendance at the tests; this reduced the failure rate from 14% in the autumn semester to 6% in the spring semester. Given that no other factors were changed, the reduction was attributed to the introduction of the blended -learning tool that allowed for guided-discovery learning for students, and to the frequency of quizzes, which may have helped students stay focused and study more.
- Online discussions involved students with the topics so that all of the students who participated in the discussions correctly answered the questions in the final exam.
- Students developed independent learning at their own pace and location, ensuring that attendance was not a barrier to learning.
- Because the LMS was coupled with the traditional classroom setting, students could learn at their own pace while connecting the topics discussed in class to real-life scenarios. As there was a huge dependence on technology, students were more engaged with the subject, taking the time to understand the language and follow up by attending the next sessions to keep abreast of the topics covered.

A Hawthorne effect, or a successful, sustainable implementation?

The primary study demonstrated the adaptation and implementation of the guided-discovery style along with a blended learning-management system to attain the following objectives (Khan 2011):

- increase student involvement with subject, peer and lecturer;
- encourage independent learning in students, giving them flexibility in scheduling their studies and taking their assessments;
- help students develop strategies to overcome language barriers, to extend their learning experiences beyond traditional methods; and
- allow business students a better learning environment to grasp computer-application concepts, thereby reducing the failure rate in the subject

It was concluded that innovative learning practices, if structured and aided by blended learning tools, could enhance business students' learning computer applications at UOWD and reduce overall failure rates in the subject.

According to Gale (2004) the Hawthorne's effect is demonstrated when people change their behaviour because they are being watched. The celebrated studies of employee behavior at the Hawthorne Plant of the Western Electric Company between 1920 and 1930 gave rise to a subsequent by-product: the Hawthorne effect. Despite the puzzlement caused in earlier research there is still not one accepted definition for the term (Draper 2002). For the purpose of this paper, the author identifies it as: When watched, a subject will automatically act differently, hence altering the course of the study.

However, disputes in the academic world have raged for years as the Hawthorne Effect has often been misguidedly used as an "[e]xocet in order to invalidate classroom-based research" (Coombs & Smith 2003 p99). Where academics have tried to use classroom settings to "determine if a new teaching method or curricular improvement might be superior to an on-going pattern of teaching or curriculum" (Cook & King 1968), others have questioned its authenticity (Cook 1967).

There already exists a body of literature that has looked at both sides of the argument, some stating that there needs to be a control that dictates whether the experiment yields true results and the researcher is an impartial observer, and others stating an expectation that researcher and his or her subjects should explicitly work together to produce results (Adair 1984; Broches 2008; Carey 1967; Diaper 1990; Drew, Hardman & Hart 1996; Gale 2004; Franke & Kaul 1978; Gransberg & Holmberg 1992; Jones 1992; Kuhn 1996; Kolata 1998; McQuarrie 2005; Rice 1992).

A year after the initial study, this follow-up study was designed to test whether the failure rates remained low with the use of guided discovery and the LMS.

The proposed hypothesis was:

The reduction in failure rate found in the primary study is a sustained effect of implementing guided discovery and blended learning.

Methodology

The primary study was carried out during the spring semester 2011 The subsequent study was conducted during summer 2011, autumn 2011 and spring 2012 (completing a year of study).

Summer 2011 was chosen as a "control", where neither guided discovery nor the LMS was used. A control was introduced primarily for two reasons (adapted from Little 2010):

- (1) to check if the system was behaving as expected from previous knowledge, experience and observations; and
- (2) to make it possible to pinpoint any errors in the experiment so they could be corrected for the next implementation.

Although the application of controls to experiments originated in medical research, the literature has shown that the reactive effects arising from conducting drug research were also encountered in

behavioral research such as this study (Adair, Sharpe & Huynh 1999); hence a control was applied to the current study.

As spring 2011 was the first semester to implement the LMS, students were informed during the semester that the system was on a trial basis and that they would be observed and recorded. However, the students in the subsequent semesters – autumn 2011, summer 2011 and spring 2012 – were not informed, as the LMS was now considered a part of the subject on offer. The author applied the same realigned subject outline from spring 2011 to autumn 2011 and spring 2012 to include the following LMS tools:

- Lecture notes and embedded videos
- Graded online discussions
- Quizzes
- Student forums

It is imperative to note that the current study included three other faculty members besides the primary author as lecturers and teaching assistants in summer 2011, autumn 2011 and spring 2012. In keeping with Shayer (1992), following three stages were implemented to try to negate the Hawthorne effect, if it existed:

- Stage 1: the initial study that highlighted the primary effect (Khan 2011).
- Stage 2: replication – could it be done by others besides the researcher (current study using other faculty members to teach the subject along with the author, using the student manual developed during the previous study)?
- Stage 3: general application – could any non-enthusiast be trained to apply the same tools? To assist other faculty members in using the LMS and guided discovery, the author developed an Instructors' Manual and held two separate workshops during autumn 2011, training others to proceed with the learning tool and associated pedagogy, particularly in autumn 2011 and spring 2012.

At the end of each semester, the grades were recorded along with student evaluations gathered by the university's quality-assurance department.

7. Results and discussion

The combination of various LMS tools and guided discovery continued to bring positive feedback from students and reduce failure rates.

Despite the involvement of more than one faculty member, the online tests proved to continually reduce administrative time for those who taught the subject over the autumn 2011 and spring 2012 semesters. This allowed the author and other faculty members to increase the frequency of quizzes and devote more time to helping students during the semester, particularly during autumn 2011, with a class size of 262.

As the frequency of tests increased and students got more involved with the subject, the failure rate decreased further. As illustrated in Figure 2, the failure rate in spring 2011 semester was the lowest recorded between 2007 and 2011, at 6.4%; autumn 2011 was 5.73% and spring 2012 (based on mock exams) was 5%. Given that no other factors were changed, the continued reduction was attributed to the use of the blended-learning tool that allowed for guided discovery

for students, and to the frequency of quizzes that helped students stay focused, study more and be more engaged with the subject.

However, the control semester, summer 2011, saw a spike in failure rate to 34.38%, providing further evidence that not using guided discovery or a learning-management system definitely hindered student learning.

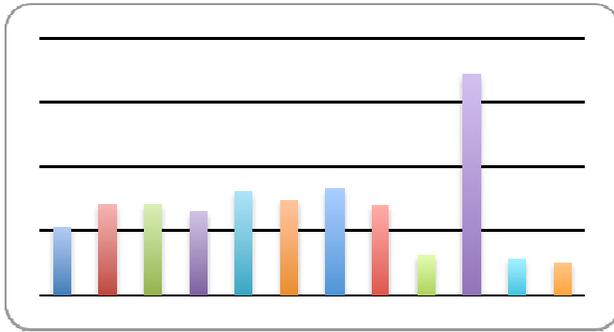


Figure 1: Failure-rate data collected from subject assessment meetings at UOWD between 2007 and 2012

Additionally,

- Over **1,200 posts** were made in the course of autumn 2011 and spring 2012 semesters, which gave an indication of student participation.
- Students corresponded with each other and lecturer(s); any issues or doubts were clarified during the semester.

According to student feedback, the LMS coupled with traditional classroom settings allowed students to:

- choose their own pace while learning;
- understand and connect the topics discussed in class to real-life scenarios, giving them a direction to the subject and familiarity; and
- be more engaged with the subject. As there was a huge dependence on technology, students took time to understand the language and follow up by attending the next sessions to keep abreast of the topics covered

(Office of Institutional Effectiveness, Autumn 2011).

Among other results (Figure 3),

- over 50% of respondents used the LMS a few times a week in both the semesters – showing considerable frequency of usage that increased from spring 2011;
- 65% of the respondents accessed the system from home, and 78% from UOWD computer labs, among other locations, showing a variety of geographically separated locations as points of access that students found to be highly convenient, similar to spring 2011;
- about 80% – an increase from spring 2011 – agreed or strongly agreed that they were comfortable with the LMS, using it from home, work or UOWD, that the instructor adequately introduced the system in the classroom and that it was easy to get started on the system; and

- over 70% – also an increase from spring 2011 – agreed that using the LMS improved their communication with the instructor and other students; gave more access to resources and learning materials; made them feel more connected to the subject; and made it easier for them to learn, supporting the overall outcomes and perceived objectives of using the learning tool.

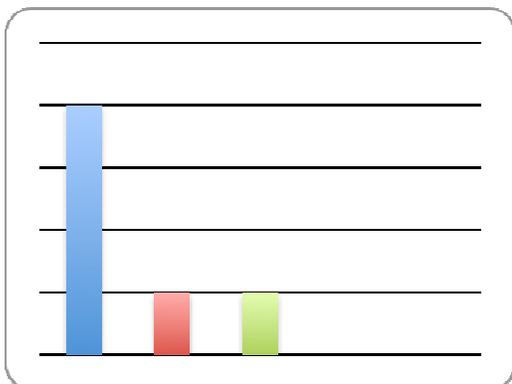


Figure 2: Summarised responses from respondents on LMS use and effectiveness

Finally, the author conducted a survey of the faculty members who had used the Instructors' Manual to determine its effectiveness (Figure 4).

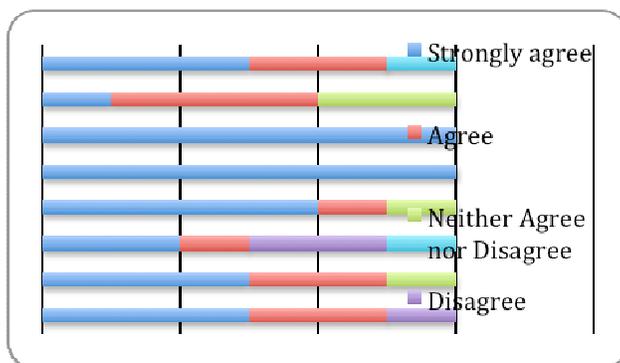


Figure 3: Response to LMS Manual and usage

As illustrated in Figures 2 and 3, the faculty members used the manual effectively to enhance their ability to use the LMS and guided discovery. The subsequent impact of their increased ability and knowledge has already been discussed in the form of reduced failure rates in autumn 2011 and spring 2012.

8. Conclusion

Understanding student needs to enhance their learning experience has been the driving force behind major shifts in teaching paradigms in the last few decades. The process is continuous, ever-

growing, ever-evolving. Teachers are trying their utmost, competing against the odds to enhance student learning through student-centered learning styles without the added pressure of facing criticism for teaching practices and pedagogy that they try out in classroom settings.

Literature has revealed that though the Hawthorne effect may not be established, and may not even have a confirmed and recognised definition, it continues to be a bane for academic researchers as they introduce evolving teaching practices through action research (Coombs and Smith 2003).

This paper looked closely at ways to combat the Hawthorne effect and accomplish the long-term sustainability of the results of the initial study by Khan (2011). The current study looked at introducing a control to better understand the impact of introducing LMS and guided discovery to aid in teaching computer applications to business students. This subsequently enhanced understanding, in that the control semester, when instructors did not use the proposed tools, showed a dramatically increased failure rate. The study also looked at introducing the three stages of research combat by Shayer (1992).

- The first stage (that of an actual study being conducted) was completed in 2011 over a period of one semester, testing the impact of introducing the LMS and guided discovery on failure rates.
- Stages two (replicating test with enthusiasts) and three (generalising to train others) were conducted over a period of two more semesters, besides the control. Both stages successfully presented lowered failure rates, indicating that the LMS tools and guided discovery were indeed effective tools to teach computer applications to business students, further reducing the likelihood of a Hawthorne effect.

Hence it is concluded that innovative learning practices, if structured and aided by blended learning tools, can enhance business students' learning in the Computer Applications subject at UOWD, and reduce overall failure rates in the subject. Moreover, this reduction can be achieved not just in the initial stages of the research, but sustainably, as the result of a cascading process to ensure lower failure rates for all semesters, all student populations, taught by any faculty following the proposed tools and pedagogy.

Draper (2010) provides food for thought for a possible area for future study:

[I]f what you care about is improving learning and the learners' experience, then you may want to maximize not avoid halo and Hawthorne effects. If you can improve learning by changing things every year, telling students this is the latest thing, then that is the ethical and practical and practically effective thing to do.

References

- Adair, J. G. (1984). The Hawthorne Effect: A Reconsideration of the Methodological Artifact. *Journal of Applied Psychology*, 69(2), 3.
- Adair, J. G. (1990). The placebo control group: An analysis of its effectiveness in educational research 59(1), 67-86.

- Anderson, J. (2010). ICT transforming education: A regional guide. UNESCO Asia and Pacific Regional Bureau for Education. Thailand. Accessed <http://unesdoc.unesco.org/images/0018/001892/189216e.pdf>
- Anderson, N. (2009). *Equity and Information Communication Technology (ICT) in Education*, Peter Lang Publishers, New York.
- BESAC (2011). Teaching Computer Applications. Business Education Statewide Advisory Committee. Accessed from <http://www.calbusinessed.org/default.asp>
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds) (1999). *How People Learn: Brain, Mind, Experience, and School*, National Academy Press, Washington, DC.
- Broches, R. S. (2008). Unraveling the Hawthorne effect: an experimental artifact "too good to die", The Honors College, Wesleyan University, Middleton, CT.
- Bruner, J. (1967). *On Knowing: Essays for the Left Hand*. Harvard University Press, Boston.
- Carey, A. (1967). The Hawthorne Studies: A Radical Criticism. *American Sociological Review*, 32(3), 403-16.
- Collis, B. (1999). Telematics-supported education for traditional universities in Europe. *Performance Improvement Quarterly*, 12(2), 36-65.
- Cook, D. L. (1967). The Impact of the Hawthorne Effect in experimental designs in educational research. Ohio State University. Bureau of Research. Accessed <http://eric.ed.gov/PDFS/ED021308.pdf>
- Cook, D. L. & King, J. (1968). A study of the Hawthorne effect in educational research. *Research in the Teaching of English*, 2(2), 93-98.
- Coombs, S. J. & Smith, I. D. (2003). Integration of critical and creative thinking skills into Singapore's IT postgraduate teacher training programme *Change: Transformations in Education*, 6(1), 97-111.
- Dewey, J. (1997). *Democracy and education*, Simon and Schuster, New York (Original work published 1916).
- Diaper, G. (1990). The Hawthorne Effect: A Fresh Examination. *Educational Studies*, 16(3), 262-265.
- Draper, S. W. (2002). The Hawthorne, Pygmalion, placebo and other effects of expectation: some notes. University of Glasgow. Accessed <http://www.psy.gla.ac.uk/~steve/hawth.html>
- Drew, C. J., Hardman, M. L. & Hart, A. W. (Eds) (1996). *Designing and Conducting Research: Inquiry in Education and Social Science*, Allyn & Bacon, Boston.
- Franke, R. H. & Kaul, J. D. (1978). The Hawthorne experiments: First statistical interpretation. *American Sociological Review*. 43(5), 638.
- Gale, E. A. M. (2004). The Hawthorne studies—a fable for our times? *QJM*, 97, 439-449.
- Grantham, D. (2005). Understanding student learning styles and theories of learning. UK Centre for Legal Education Consortium on Enhancing Academic Practice. Accessed <http://www.ukcle.ac.uk/resources/teaching-and-learning-practices/grantham2/>
- Hepp, P., Hinojosa, J. E., Laval, E. & Rehbein, L. (2004). *Technology in schools: Education, ICT and the knowledge society*, World Bank, Washington, DC.
- Jones, S. R. (1992). Was there a Hawthorne effect? *American Journal of Sociology*, 98(3), 467.
- Khan, Z. R. (2011). Learning Management Systems and Guided Discovery: innovative learning tools to teaching computer-application to business students. IASTED International Conference on Technology for Education Proceedings, 14-16 December 2011, Dallas.
- Khan, Z. R. & Samuel, S. D. (2009). E-cheating, online sources and technologies – a critical review of existing literature. Presented at 9th Global Conference of Business and Economics. Cambridge University, UK, 16-17 October.
- Kolata, G. (1998). Scientific myths that are too good to die. *New York Times*, 163, D7.

- Kozma, R. (2005) National policies that connect ICT-based education reform to economic and social development. *Human Technology* [Electronic], 5(4), 358-367. Accessed from www.humantechnology.jyu.fi/current/abstracts/kozma05.html.
- Kozma, R. & Anderson, R.E. (2002) Qualitative case studies of innovative pedagogical practices using ICT. *Journal of Computer-Assisted Learning*, 18, 387-394.
- Kuhn, T. S. (1996). *The Structure of Scientific Revolutions*, The University of Chicago Press, Chicago.
- Little, J. W. (2010). The Importance of Control Experiments. University of Arizona. Accessed from <http://www.biochem.arizona.edu/classes/bioc568/bioc568.htm>.
- Lundgren, C. A., Lundgren, T. D. & Mundrake, G. A. (1995). Teaching Computer Applications. Delta Pi Epsilon USA.
- McQuarrie, F. A. E. (2005). How the past is present(ed): A comparison of information on the Hawthorne studies in Canadian management and organizational behaviour textbooks. *Canadian Journal of Administrative Sciences*, 22(3), 230.
- Office of Institutional Effectiveness (2007-2010). Subject Evaluation for Computer Application. Confidential semester evaluation summaries available at the Office of Institutional Effectiveness, University of Wollongong, Dubai.
- Office of Institutional Effectiveness (2011). Subject Evaluation for Computer Application. Confidential semester evaluation summaries available at the Office of Institutional Effectiveness, University of Wollongong, Dubai.
- Piaget, J. (1954). *Construction of Reality in the Child*, Basic Books, New York.
- Resta, P. & Patru, M. (Eds). (2010). *Teacher Development in an E-learning Age: A Policy and Planning Guide*, UNESCO, Paris.
- Rice, B. (1992). The Hawthorne defect: Persistence of a flawed theory. *Psychology Today*, 16(2), 71-74.
- Shayer, M. (1992). Problems and issues in intervention studies. In Demetriou, A., Shayer, M. & Efklides, A. (Eds), *Neo-Piagetian Theories of Cognitive Development: Implications and Applications for Education*, Routledge, London, 107-121.
- Singh, H. & Reed, C. (2001). A white paper: Achieving success with blended learning. Accessed <http://www.leerbeleving.nl/wbts/wbt2014/blend-ce.pdf>
- Subject Outline (Spring 2011). Computer Applications. Syllabus prepared at the beginning of the semester, quality assured and handed out to students. Subject Folder. Faculty of Computer Science and Engineering, University of Wollongong, Dubai.
- Subject Report (2007-2011). Reports available in subject folders based on final grades of students produced for Faculty assessment meetings every semester at Faculty of Computer Science and Engineering, University of Wollongong, Dubai.
- UNESCO (2010). Higher Education and ICTs. Accessed <http://www.unesco.org/en/higher-education/higher-education-and-icts/>
- Unwin, T. (Ed.) (2009). *ICT4D: Information and Communication Technology for Development*, Cambridge University Press, Cambridge.
- Vygotsky, L.S. (1978). *Mind in Society: The Development of Higher Psychological Processes*, Harvard University Press, Boston.