European Journal of Engineering Education

ISSN: 0304-3797 (Print) 1469-5898 (Online) Journal homepage: http://www.tandfonline.com/loi/ceee20

Time pressure in scenario-based online construction safety quizzes and its effect on students' performance

Martin Jaeger & Desmond Adair

EUROPEAN JOURNAL OF ENGINEERING EDUCATION, 2017
VOL. 42, NO. 3, 241–251
http://dx.doi.org/10.1080/03043797.2016.1153042

Time pressure in scenario-based online construction safety quizzes and its effect on students' performance

Martin Jaeger and Desmond Adair

School of Engineering, University of Tasmania, Tasmania, Australia

ABSTRACT

Online quizzes have been shown to be effective learning and assessment approaches. However, if scenario-based online construction safety quizzes do not include time pressure similar to real-world situations, they reflect situations too ideally. The purpose of this paper is to compare engineering students' performance when carrying out an online construction safety quiz *with* time pressure versus an online construction safety quiz *without* time pressure. Two versions of an online construction safety quiz are developed and administered to randomly assigned engineering students based on a quasi-experimental post-test design. The findings contribute to scenario-based learning and assessment of construction safety in four ways. First, the results confirm earlier findings that 'intrinsic stress' does not seem to impair students' performance. Second, students who carry out the online construction safety quiz *with* time pressure are less likely to 'learn by trial and error'. Third, students exposed to time pressure appreciate that they become better prepared for real life. Finally, preparing students to work under time pressure is an important industry requirement. The results of this study should encourage engineering educators to explore and implement ways to include time pressure in scenario-based online quizzes and learning.

ARTICLE HISTORY
Received 18 June 2014
Accepted 1 February 2016

KEYWORDS
Online quiz; construction safety; time pressure; student performance; construction management

1. Introduction

1.1. Time pressure and construction safety

Many construction engineering activities are performed under time pressure. This inevitably has an impact on an engineer's attitude and performance and, therefore, also on construction safety. Time pressure and its negative impact on construction safety have already been shown (Bahn 2009). These may even cause field supervisors to consciously pursue unsafe situations in order to save time (Garrett and Teizer 2009). Poor management commitment, which may be a result of time pressure, has been also identified as an important reason for construction accidents and construction fatalities (Teo, Ling, and Chong 2005; Ling, Liu, and Woo 2009; Garrett and Teizer 2009; Hu et al. 2011). In a recent study, a modified loss causation model was applied in order to analyse 140 fatal construction accidents in Singapore. It was concluded that most job factors which contributed to the accidents were the responsibility of the site manager (Miang 2004, 52). Although knowledge and procedures stemming from the site manager are an important first step towards hazard identification on construction sites (Carter and Smith 2006), the less obvious and difficult-to-quantify construction management beliefs and attitudes (Jaeger and Adair 2010; Zou 2011), and the resulting behaviour,

CONTACT Martin Jaeger martin.jaeger@utas.edu.au

have a major impact on construction safety (Duff et al. 1994; Fitzgerald 2001; Koh and Rowlinson 2011).

In addition, negligence, passivity, and training inadequacies have been identified as having major impacts on construction safety (Garrett and Teizer 2009). This is especially true of negligence and passivity which may be the result of time pressure on construction sites. Although construction/site management is one of the two most cost-effective safety programme elements (Hallowell 2010), it may be the most vulnerable element to time pressure.

1.2. Construction safety in construction management education

Although not all construction safety issues are a consequence of time pressure, it needs to be noted that safety training is sometimes fairly unreal in that it focuses exclusively on safety issues (Smith and Arnold 1999, 265–270) and ignores a real-life context including time pressure. Safety training, which is primarily based on safety regulations, does not lead to the required improvement of safety on construction sites (Gibb et al. 2006). Al-Mufti (1999) suggested the inclusion of social and psychological aspects into construction training. This inclusion and the integration of safety issues into the construction management units were achieved by implementing innovative assessment techniques ('Zero tolerance assessment' and '360 degree feedback via the World Wide Web') at the University of Portsmouth, and students' attitude towards safety and their knowledge of safety improved significantly (Petersen, Reynolds, and Ng 2008).

For construction managers in real-world situations, safety issues are side issues interwoven into other activities which are usually given priority. This is especially true in situations of intensifying time pressure and students should be required to learn how to reconcile and manage such conflicting constraints (Jonassen, Strobel, and Lee 2006). The authors of this paper propose to supplement safety training with simulations of real-world construction situations, which include time pressure.

Scenario-based online quizzes, that is, online quizzes based on real-life scenarios (Raghavendra and Rajini 2012) have been found to have advantages over traditional quizzes since they combine the advantages of computer-based assessments (Mattheos et al. 2008) with the advantage of assessing skills and knowledge required for real-life situations (i.e. industry expectation; Nair and Patil 2008; Jaeger and Adair 2010). This makes scenario-based online quizzes a suitable assessment strategy for construction safety training. However, it produces the question, 'how does built-in time pressure in scenario-based online construction safety quizzes affect the students' performance'?

The remainder of the paper summarises the background regarding time pressure in learning, followed by the research purpose, method, discussion, and conclusions.

1.3. Time pressure and its impact on students' performance

Learning environments may produce different sources of stress such as academic workload, too many tests, difficult courses, examination grades, and lecturer characteristics (Ong and Cheong 2009). Stress is caused when students perceive the knowledge to be acquired as too extensive and, at the same time, they perceive the available time to acquire the knowledge as being inadequate (Carveth, Gesse, and Moss 1996). However, it has been shown that stress in academic institutions can have both positive and negative consequences dependent on how stress is managed (Stevenson and Harper 2006).

Looking at the learning process, Goodie and Crooks (2004) showed the literature includes substantial evidence for time pressure leading to more heuristic processing, but the literature also shows that this does not necessarily mean worse performance. Furthermore, Goodie and Crooks (2004) proved experimentally that time pressure may lead to an improved performance. Time pressure has the potential to improve learning and memory formation in spite of a common perspective that time pressure has a negative impact (Bisaz, Conboy, and Sandi 2009).

Finally, it should not be overlooked that many researchers in the field of behavioural science concluded that the topic of stress, of which time pressure is a major cause, requires more research (Agolla 2008) and that the effect of stress on memory and learning is very variable (Shors 2006; Zoladz, Park, and Diamond 2011). Therefore, it seems necessary to test the impact of increased time pressure on students' performance when carrying out an online construction safety quiz *with* time pressure versus an online construction safety quiz *without* time pressure.

2. Purpose

The purpose of this study is to answer the following teaching and learning questions:

(1) On comparing the two versions of scenario-based online construction safety quizzes: Does the version *with* time pressure reduce students' performance?
(2) For both, the online quiz *with* time pressure and the online quiz *without* time pressure: What are the relationships between variables that influence students' performance on the one side, and the students' performance on the other side?

The most important influential variables as identified by the instructor who applied the online quizzes were:

- Number of attempts until students derived correct reactions according to OSHA (OSHA 2012);
- Students' motivation to derive correct reactions according to OSHA (OSHA 2012);
- Students' perception of online quizzes' ease of use; and,
- Students' perception of a need to learn new concepts.

(3) Do these influential variables influence the students' performance differently between the online quiz *with* time pressure versus the online quiz *without* time pressure?
(4) Which set of influential variables best predicts the students' performance when carrying out the online quiz *with* time pressure?

3. Method

The following sections describe the experimental design, nature, and size of the sample, the experiment, and its results.

3.1. Design

The study is based on a quasi-experimental post-test design which compares the students' performance of an experimental group (i.e. a group of students exposed to the online quiz with time pressure) with the performance of a control group (i.e. a group of students exposed to the same online quiz, but without time pressure). The time pressure for the experimental group was caused by the count-down of a given time limit and reoccurring on-screen messages which strongly suggested that the student should speed up. Pre-tests with three average-performing volunteering students who were not part of the experiment were carried out in order to 'calibrate' the time limit in a way that allowed merely enough time to understand the scenario and to give prompt answers and, thereby, confirmed the effectiveness of the generated time pressure. The resulting time limits for the scenarios varied from 45 to 120 seconds since the scenarios included tasks of different complexity. However, the time limit selected should not be overestimated for the research questions considered here. For the questions considered here, it is merely important that the experimental group is exposed to more time pressure than the control group. The impact of different intensities of time pressure is beyond the scope of this study and could be considered for future research.

3.2. Sample

The population comprised 58 students who were in their second year of a university engineering course, with the students randomly assigned to the experimental and the control groups. Three students dropped out which led to a response rate of 95%. Although the sample size of both, experimental and control groups, is smaller than suggested by the rule of the thumb that says that a sample should have at least a size of 30 (Hauschildt and Hamel 1978, 237), it was considered here that the quality of survey results was found to improve insignificantly beyond 20 respondents (Zahn 1993). Furthermore, and since both groups show similar results in other assessment tasks and both groups were exposed to the same preparation for the experiment, the research situation meets the requirements for a *quasi-experiment* (Beins 2009, 102). Therefore, the small sample sizes were considered sufficient given the exploratory character of the research presented here. The average students' age of the sample was 21.5 years, 58% of the students were male, and none of the students had any construction site experience through internships or work assignments.

All students came from a comparable socio-economic background and were used to a competitive learning environment. During their preceding secondary education, students had chosen science as their major, and they passed a university entrance examination with 70% or higher in order to be admitted to the university's engineering course.

3.3. Experimental situation

Within the same teaching week and as part of the students' formative assessment, both groups were exposed to in-house-developed online quizzes written using the JAVA programming language. In contrast to the online quiz *without* time pressure (control group), the online quiz *with* time pressure required the students of the experimental group to carry out a short English proficiency test based on an internet-based online test (Exam English 2012). This resulted in an English proficiency index which was used by the online quizzes to determine the available time for each of the 16 scenarios (i.e. extend of time pressure) and, hence, reduced the influence of varying levels of English skills on the students' performance.

For both groups of students the scenarios were identical and included personalised 'real-world' questions (e.g. 'Your boss is asking you: How many courses of brickwork are finished?', etc., Figure 1) which students were asked to answer based on displayed images (taken from OSHA 2012). These questions served as 'distraction from safety awareness' in order to simulate 'real-world' situations where construction personnel are focussing more on productivity and quality rather than on safety. Construction safety aspects were added by three multiple-choice questions, introduced with, 'By the way, what else would you do looking at the displayed situation?' For all scenarios, the given choices regarding safety aspects included choices which were correct or incorrect (based on previously learnt safety regulations), and they presented conflicts regarding time and cost, similar to situations students will face at the work place. After responding to all questions, students had extra time to click on 'Get feedback' in order to receive feedback on their answers. In case they provided an incorrect answer, the program did not reveal the correct answer, but provided a question that facilitated students' rethinking process.

Finally, both groups of students were required to complete a questionnaire in order to evaluate the influential variables and, in order to increase reliability, students were asked to give a reason for each evaluation. In order to measure the learning outcome, students had to complete a quiz comprising 32 True/False questions related to construction safety issues which were part of the previously simulated scenarios.

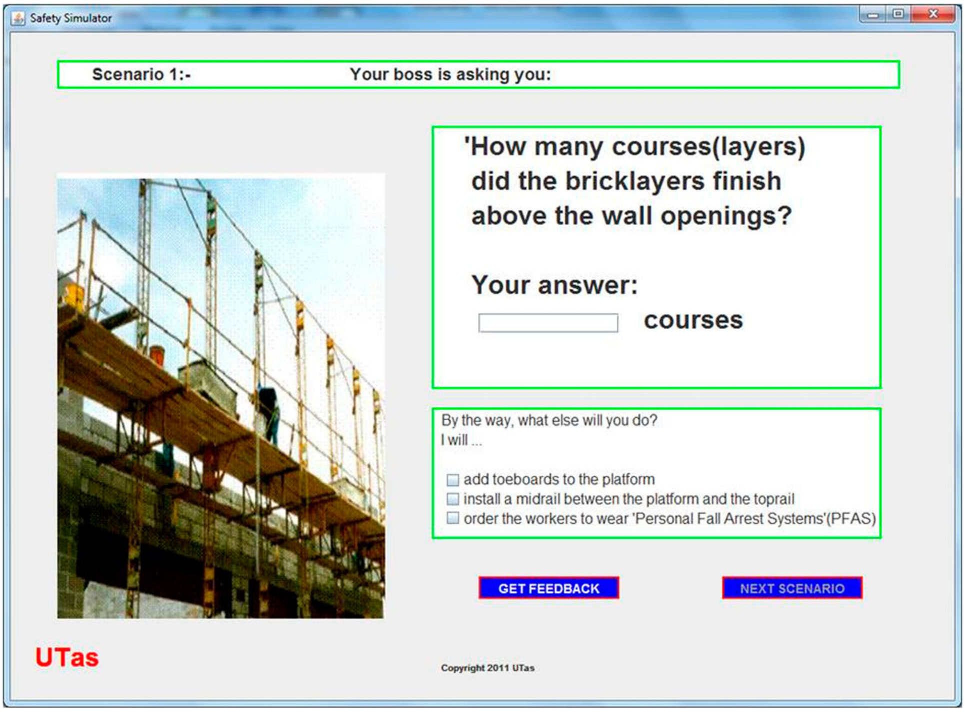

Figure 1. Construction safety simulator surface.

All students of both groups had been exposed to the same lecture carried out by the same lecturer on construction safety, one week prior to the experiment and supervised during their online quiz by the same teaching staff in order to avoid bias.

3.4. Variables

Since there are no data available across the years and since the structures of the different cohorts are not necessarily comparable, Lucas's (1997) recommendation of receiving direct feedback on the learning activity was used. The students' performance (dependent variable, named score) was measured by the resulting score of the True/False quiz. Schernhammer et al. (2004) have pointed out some difficulties involved in measuring variables that reflect subjective perceptions. Therefore, following the approach of Ponzurick, Franceand, and Logar (2000), who justified measuring students' satisfaction through a single item, it was decided to measure students' perception of motivation towards giving correct answers as a single item on a 5-point Likert response scale. Single-item measures have been recommended before (Rossiter 2002) and it has been shown that constructs such as perceptions can be measured reliably by single-item measures (Bergkvist and Rossiter 2007).

Table 1 shows a description of the influential variables, their names as they are used in the following, and the scale which was used for measurement.

Table 1. Influential variables.

Influential variable	Variable name	scale
Number of attempts to answer correctly	*attempts*	real number
Motivation to give correct answers	*motivation*	5 points response scale (1 = very low, 5 = very high)
Simulator ease of use	*ease of use*	Yes, No
New aspects required to be learned	*new aspects*	Yes, No

Table 2. ANOVA of students' performance and influential variables by simulator version.

	with time pressure			*without* time pressure					
	Mean	SD	*N*	Mean	SD	*N*	*F*-value	*F* crit	*P*-value
score	22.14	3.67	28	22.26	2.960	27	0.017	4.023	.90

Table 3. Correlation of influential variables with the students' performance for each simulator version.

	with time pressure	Sample Size	*P*-Value	*without* time pressure	Sample Size	*P*-Value
attempts	0.03	28	0.90	0.23	27	0.77
motivation	0.38	28	0.09	−0.15	27	0.26
ease of use	−0.08	28	0.68	−0.07	27	0.34
new aspects	−0.34	28	0.14	−0.08	27	0.46

Finally, the students' general interest in construction management (interest) and their gender (gender) were recorded and considered to replace pre-test measures. The general interest was measured based on a 5-point Likert response scale (1 = very low, 5 = very high).

4. Analysis of data and results

Data analysis was carried out using Microsoft Excel's data analysis add-on. In order to reveal potential differences between the experimental group and the control group, the two pre-test variables (interest, gender) were analysed by applying an analysis of variance (ANOVA). Because of the small sample sizes (WHO 2001, 82), the confidence interval has been set at $p = .90$, which means here that no significant differences were found and aspects which may have threatened the validity because of a possible selection bias were controlled.

To answer the first research question, an ANOVA was applied to compare the students' performance between the two student groups. The mean value, sample size *N*, and standard deviation SD are shown for the experimental and the control groups (i.e. students under time pressure and students without time pressure), and the *F*-value (i.e. the ratio of between-groups variance and within-group variance), the critical *F*-value (i.e. *F*-values above the critical *F*-value indicate a significant difference), as well as the confidence interval P underlying the critical *F*-value are shown in Table 2. The result shows that the inclusion of 'real-world' time pressure did not significantly reduce students' performance when carrying out the online quiz with time pressure. Furthermore, the very low *F*-value confirms the homogeneity of the groups of students considered here.

The second research question was aimed at exploring the relationships between the influential variables (attempts, motivation, ease of use, new aspects) and the students' performance (score) for both online quiz types. Table 3 shows that the number of attempts does significantly not correlate with the students' performance and the other three influential variables show insignificant correlation with the students' performance when carrying out the online quiz *with* time pressure. Furthermore, all influential variables show insignificant correlations with the students' performance when carrying out the online quiz *without* time pressure.

The third research question explores if there are any differences of influence on the students' performance dependent on the online quiz type. Table 4 contains the results of an ANOVA and shows

Table 4. ANOVA of students' performance and influential variables by simulator version.

	with time pressure			*without* time pressure					
	Mean	SD	*N*	Mean	SD	*N*	*F*-value	F_{crit}	*P*-value
attempts	43	3.65	28	41	3.87	27	3.506	4.023	.07
motivation	3.89	0.74	28	3.81	0.85	27	0.135	4.023	.71
ease of use	4.14	1.67	28	4.36	1.5	27	0.392	4.023	.53
new aspects	4	1.76	28	3.77	1.88	27	0.144	4.023	.71

Table 5. Regression analysis of influential variables on students' performance for simulator with time pressure.

	Beta standardised coefficients	*t*-value	*P*-value
Intercept		5.69044E-16	
attempts	0.023	0.122	.90
motivation	0.333	1.751	.09
easeof use	0.081	0.417	.68
new aspects	−0.299	−1.525	.14

Notes: Model $F = 1.644383763$ ($F_{crit} = 0.19721518$);
df = 4.
Total R square = 0.2223828.

that there are no significant differences regarding the shown influential variables on students' performance.

To answer the fourth research question, 'Which set of influential variables best predicts the students' performance when applying the online quiz with time pressure?', a multiple regression analysis was carried out. Table 5 depicts the result and shows that only the variable attempts plays a significant role in contributing to high scores when applying the online quiz with time pressure.

5. Discussion

The performance (i.e. quiz results) of students who carried out the online quiz *with* time pressure has been shown to be essentially the same as the performance of students who carried out the online quiz *without* time pressure. This may point towards an overestimation of time pressure as a negative factor for learning, which would confirm earlier findings which have shown that time pressure has in fact not necessarily a negative effect on learning (Goodie and Crooks 2004). The frequency of reasons the students gave in support of their perception that the online quiz caused stress confirms the felt impact of time pressure: The largest group (10 out of the 28 students) who carried out the online quiz *with* time pressure made explicit remarks related to the feeling of time pressure, followed by 6 students who found the tasks difficult and a variety of other reasons. This was contrary to the students who carried out the online quiz *without* time pressure; they mentioned neither time pressure, nor any difficulty of tasks. At the same time, 7 (out of 28) students who carried out the online quiz *with* time pressure mentioned that the quiz prepared them better for their professional life than lectures about construction safety. Among the students who carried out the online quiz *without* time pressure, there were only 2 (out of 27) students who made remarks along the same line. In line with previous research (Bisaz, Conboy, and Sandi 2009), the results show that time pressure has the potential to improve learning and memory formation in spite of a common perspective that time pressure has a negative impact (Bisaz, Conboy, and Sandi 2009).

The result for the second research question, that is, the number of attempts has essentially no influence on students' performance when carrying out the online quiz *with* time pressure, may be interpreted as follows. The online quiz *with* time pressure did not allow for 'trial and error' in order to choose the correct answer. This confirms also that the set time pressure was adequate. Although the remaining correlations between influential variables and students' performance were found to be insignificant, they may be considered pointing towards two interesting trends, which may be suggested for further research. First, whereas the number of attempts which were necessary to reach a correct answer had basically no influence on the performance for students who carried out the online quiz *with* time pressure, the number of attempts correlated higher than the other three influential variables for students who carried out the online quiz *without* time pressure. This confirms the previous interpretation of a tendency of students to prefer 'learning by trial and error' if they are not exposed to time pressure. Secondly, the correlation of motivation with the score for the two online quiz versions is converse. The motivation of students under time pressure contributed to high performance, whereas this was the opposite for students who were not under time pressure. Because there was no time pressure and only a limited number of possible answers, the students tended towards 'trial and error', and their motivation to give acceptable answers became less important for high performance. This confirms Bisaz, Conboy, and Sandi (2009) and others (Joëls et al. 2006; Sandi and Pinelo-Nava 2007) who found that in general 'intrinsic stress' (caused by elements of the cognitive task that cause stress) seems to have a positive impact on learning.

The results related to the third research question show no significant difference between the two groups regarding the influential variables. Contrary to what may have been expected based on previous research that showed a correlation between students' performance and the perceived ease of use (Schneberger, Amoroso, and Durfee 2007), the ease of use was not perceived lower for the online quiz *with* time pressure. This may also be considered a consequence of the relatively low level of time pressure. Further research with various stages of increased time pressure would need to confirm this interpretation.

Furthermore, the fact that the test with time pressure did neither lead to significantly fewer attempts, nor did it lead to reduced performance, may be interpreted with the chosen, low-level time pressure. Students did not feel a need to skip questions, and they were still able to perform high. The regression model, carried out to answer the fourth research question, indicates that attempt is the only influential variable which significantly predicts students' performance when carrying out the online quiz *with* time pressure. This confirms the previous interpretations and highlights the importance of calibrating the time limits for each scenario to a level which does not encourage 'trial and error'.

In summary, the results show that an increased time pressure in order to reflect scenarios more realistically does not impede students' performance. Furthermore, students who carried out the online quiz *with* time pressure appreciated more frequently the fact that they become better prepared for 'real life' than students who carried out the online quiz *without* time pressure. Although the primary intention for the development of an online quiz *with* time pressure was the improvement of the reflection of 'real-world' scenarios, the results here indicate also a necessity for the inclusion of an adequate level of time pressure, in order to avoid 'learning by trial and error'. Finally, the online quiz *with* time pressure contributes to meeting an important industry requirement, namely, preparing students to work under time pressure (Nair and Patil 2008; Gavriloski, Jovanova, and Kaemper 2012).

5.1. Limitations

The following potential threats to validity of results have been identified. The construct validity of the research presented here might be limited since measuring motivation and ease of use are difficult concepts which can only be captured with subjective measurement instruments (Turner 1995). A selection effect was avoided by assigning students randomly to the two groups and the ANOVA of pre-test replacing variables confirmed the internal validity. The experimental design, which included carrying out the experiment during normal class room times, avoided students dropping out beyond the students who were missing on that day. A maturation effect caused by familiarisation and maturing was avoided by carrying out the experiment for all students of the same group at the same time. Concerning the external validity it can be expected that the results of the study are to some degree representative for the category of students found here. Students with different educational backgrounds, fields of study, and socio-economic contexts may lead to different results. Furthermore, since it was the first time for the students to carry out the online quiz, it may have caused a Hawthorne effect (modification of their perception as a reaction to the fact that they are studied) in the students which may have influenced their perception of motivation and ease of use. The exploratory character of the research presented here and the relatively small sample size need to be recognised and following further investigations might lead to more generalised future results.

6. Conclusion

This study was designed to compare the performance of students carrying out a scenario-based online construction safety quiz *with* time pressure, with those carrying out a scenario-based online construction safety quiz *without* time pressure. Furthermore, the influence of the necessary number of attempts until students derived an acceptable reaction, their motivation to score high, the online quizzes' ease of use, and aspects students perceived to be necessary to learn (influential variables) were analysed.

The results and findings of this study contribute to scenario-based learning of construction safety in different ways. First, this research confirms earlier findings that 'intrinsic stress', as it is caused by time pressure, does not seem to impair the students' performance. Secondly, students carrying out the online quiz *with* time pressure seem to be less prone to 'learn by trial and error'. Thirdly, students exposed to time pressure appreciated that they become better prepared for real life. Fourthly, the online quiz *with* time pressure contributes to meeting an important industry requirement by preparing students to work under time pressure.

The results of this study should encourage engineering educators and institutions of engineering education to explore and implement ways to include time pressure in scenario-based online quizzes and learning.

Notes on contributors

Martin Jaeger holds a Ph.D. in Civil Engineering (Construction Economy and Management) from the University of Wuppertal, Germany. He spent the last 18 years working as site manager, consultant, and lecturer in Germany and the Middle East, is a University Associate with the University of Tasmania, Australia, and an Associate Professor with the Australian College of Kuwait.

Desmond Adair holds a PhD in Aerodynamics from Imperial College. He spent a number of years working as a Senior Research Engineer with NASA in California and NPL in Teddington, England. Dr Adair has also worked for British Aerospace and the UAE Defence Forces in senior education positions and before his present position as Professor with Nazarbayev University, he was a Senior Lecturer and University Associate with the University of Tasmania, Australia.

References

Agolla, J. E. 2008. "Occupational Stress among Police Officers. The Case of Botswana Police Service." *Research Journal of Business Management* 2 (1): 25–35.

Al-Mufti, M. A. 1999. "Continuous Enhancement of Health and Safety Awareness in Undergraduate Civil Engineering Courses." In *Proceedings, Second International Conference of CIB W99, Implementation of Safety and Health on Construction Sites*, edited by A. Singh, J. Hinze, and R. J. Coble, 277–282. Rotterdam: Balkema.

Bahn, S. 2009. "Power and Influence: Examining the Communication Pathways Influencing Safety in the Workplace." *Journal of Health, Safety and Environment* 25 (3): 213–222.

Beins, B. C. 2009. *Research Methods*. Boston, MA: Pearson Education.

Bergkvist, L., and J. R. Rossiter. 2007. "The Predictive Validity of Multiple-item vs. Single-item Measures of the Same Constructs." *Journal of Marketing Research* 44 (2): 175–184.

Bisaz, R., L. Conboy, and C. Sandi. 2009. "Learning under Stress: A Role for the Neural Cell Adhesion Molecule NCAM." *Neurobiology of Learning and Memory* 91: 333–342.

Carter, G., and S. D. Smith. 2006. "Safety Hazard Identification on Construction Projects." *Journal of Construction Engineering and Management* 132 (2): 197–205.

Carveth, J. A., T. Gesse, and N. Moss. 1996. "Survival Strategies for Nurse-midwifery Students." *Journal of Nurse-Midwifery* 41 (1): 50–54.

Duff, A. R., R. A. Robertson, R. A. Phillips, and M. D. Cooper. 1994. "Improving Safety by the Modification of Behaviour." *Construction Management and Economics* 12: 67–78.

Exam English. 2012. Exam English Limited. *Free online English Test*. Accessed June 18. http://examenglish.com/IELTS/IELTS_general_reading1.htm.

Fitzgerald, B. 2001. "Construction Behaviour-Based Safety: It's Easier than you Think." *Proceedings of ASSE Professional Development Conference and Exposition*, June 10–13, Anaheim, California.

Garrett, J. W., and J. Teizer. 2009. "Human Factors Analysis Classification System Relating to Human Error Awareness Taxonomy in Construction Safety." *Journal of Construction Engineering and Management* 135 (8): 754–763.

Gavriloski, V., J. Jovanova, and K. P. Kaemper. 2012. "Project-oriented Approach in Mechatronic Education in Macedonia, Kosovo and Montenegro." *Proceedings of Mechatronics (MECATRONICS), 9th France-Japan & 7th Europe-Asia Congress on Research and Education in Mechatronics (REM), 13th Int'l Workshop*, edited by IEEE, 231–236.

Gibb, A. G. F., R. Haslan, D. E. Gyi, S. Hide, and R. Duff. 2006. "What Causes Accidents?" *Proceedings of ICE – Civil Engineering* 159 (6): 46–50.

Goodie, A. S., and C. L. Crooks. 2004. "Time-Pressure Effects on Performance in a Base-rate Task." *The Journal of General Psychology* 131 (1): 18–28.

Hallowell, M. 2010. "Cost-effectiveness of Construction Safety Programme Elements." *Construction Management and Economics* 28 (1): 25–34.

Hauschildt, J., and W. Hamel. 1978. "Empirische Forschung zur Zielbildung in Organisationen [Empiric Research of Goal Setting in Organizations]." *Hamburger Jahrbuch für Wirtschafts- und Gesellschaftspolitik*: 237–250.

Hu, K., H. Rahmandad, T. Smith-Jackson, and W. Winchester. 2011. "Factors Influencing the Risk of Falls in the Construction Industry: A Review of the Evidence." *Construction Management and Economics* 29 (4): 397–416.

Jaeger, M., and D. Adair. 2010. "Human Factors Simulation for Construction Management Education." *European Journal of Engineering Education* 35 (3): 299–309.

Joëls, M., Z. Pu, O. Wiegert, M. S. Oitzl, and H. J. Krugers. 2006. "Learning under Stress: How Does It Work?" *Trends in Cognitive Sciences* 10 (4): 152–158.

Jonassen, D., J. Strobel, and C. B. Lee. 2006. "Everyday Problem Solving in Engineering: Lessons for Engineering Educators." *Journal of Engineering Education* 95 (2): 139–151.

Koh, T. Y., and S. Rowlinson. 2011. "Relational Approach in Managing Construction Project Safety: A Social Capital Perspective." *Accident Analysis and Prevention* 48: 134–144.

Ling, F. Y. Y., M. Liu, and Y. C. Woo. 2009. "Construction Fatalities in Singapore." *International Journal of Project Management* 27 (7): 717–726.

Lucas, U. 1997. "Active Learning and Accounting Educators." *Accounting Education* 6 (3): 189–190.

Mattheos, N., N. Stefanovic, P. Apse, R. Attstrom, J. Buchanan, P. Brown, A. Camilleri, et al. 2008. "Potential of Information Technology in Dental Education." *European Journal of Dental Education* 12 (1): 85–91.

Miang, G. Y. 2004. "A Case-based Reasoning Approach to Construction Safety Risk Assessment." Thesis submitted for the degree of Doctor of Philosophy, Department of Civil Engineering, National University of Singapore.

Nair, C. S., and A. Patil. 2008. "Industry versus Universities: Re-engineering Graduate Skills - A Case Study." *Proceedings of AUQF2008, Quality & Standards in Higher Education: Making a Difference, Canberra, Australia, July 9–11*, 75–80.

Ong, B., and K. C. Cheong. 2009. "Sources of Stress among College Students - The Case of a Credit Transfer Program." *College Student Journal* 43 (4): 1279–1286.

OSHA. 2012. *OSHA 10-Hour Construction Industry Outreach-Trainer Presentations*. Accessed June 18. http://www.osha.gov/dte/outreach/construction_generalindustry/const_outreach_tp.html.

Petersen, A. K., J. H. Reynolds, and L. W. T. Ng. 2008. "The Attitude of Civil Engineering Students Towards Health and Safety Risk Management: A Case Study." *European Journal of Engineering Education* 33 (5–6): 499–510.

Ponzurick, T. G., K. R. Franceand, and C. M. Logar. 2000. "Delivering Graduate Marketing Education: An Analysis of Face-to-face Versus Distance Education." *Journal of Marketing Education* 22 (3): 180–187.

Raghavendra, N., and R. Rajini. 2012. "A Qualified Analysis of Traditional and Technology Assisted Learning-an IT Industry Outlook." In *Engineering Education: Innovative Practices and Future Trends (AICERA)*, 2012 IEEE International Conference, 1–6. IEEE.

Rossiter, J. R. 2002. "The Coarse Procedure for Scale Development in Marketing." *International Journal of Research in Marketing* 19 (2): 305–335.

Sandi, C., and M. T. Pinelo-Nava. 2007. "Stress and Memory: Behavioural Effects and Neurobiological Mechanisms." *Neural Plasticity*. doi:10.1155/2007/78970.

Schernhammer, E. S., S. E. Hankinson, B. Rosner, C. H. Kroenke, W. C. Willett, G. A. Colditz, and I. Kawachi. 2004. "Job Stress and Breast Cancer Risk – The Nurses" Health Study." *American Journal of Epidemiology* 160 (11): 1079–1086.

Schneberger, S., D. L. Amoroso, and A. Durfee. 2007. "Factors That Influence the Performance of Computer-based Assessments: An Extension of the Technology Acceptance Model." *The Journal of Computer Information Systems* 48 (2): 74–90.

Shors, T. J. 2006. "Stressful Experience and Learning Across the Lifespan." *Annual Review of Psychology* 57: 55–85.

Smith, G. R., and T. M. Arnold. 1999. "Safety Education Expectations for Construction Engineering and Management Students." In *Implementation of Safety and Health on Construction Sites*, edited by A. Singh, J. Hinze, and R. J. Coble, 265–272. Rotterdam: Balkema.

Stevenson, A., and S. Harper. 2006. "Workplace Stress and the Student Learning Experience." *Quality Assurance in Education* 14 (2): 167–178.

Teo, E. A. L., F. Y. Y. Ling, and A. F. W. Chong. 2005. "Framework for Project Managers to Manage Construction Safety." *International Journal of Project Management* 23: 329–341.

Turner, J. C. 1995. "The Influence of Classroom Contexts on Young Children's Motivation for Literacy." *Reading Research Quarterly* 30 (3): 410–441.

WHO. 2001. *Health Research Methodology: A Guide for Training in Research Methods*. 2nd ed. Manila: World Health Organization, Regional Office for the Western Pacific.

Zahn, E. 1993. *Marketing-und Vertriebscontrolling: Produkt-und Sortimentspolitik, Distributionspolitik, Preispolitik, Werbung, Verkaufsförderung, Konkurrenz-Analyse* [Marketing and Distribution Controlling: Product and Range Policy, Distribution Policy, Price Policy, Advertising, Sales Promotion, Competition Analysis]. Landsberg a.L.: Moderne Industrie.

Zoladz, P. R., C. R. Park, and D. M. Diamond. 2011. "Neurobiological Basis of the Complex Effects of Stress on Memory and Synaptic Plasticity." In *The Handbook of Stress: Neuropsychological Effects on the Brain*, edited by C. D. Conrad, 157–178. Oxford: Wiley-Blackwell.

Zou, P. X. W. 2011. "Fostering a Strong Construction Safety Culture." *Leadership and Management in Engineering* 11 (1): 1–11.