

How are quiz scores related to students' performance in blended-learning?

M. SACRÉ, D. LAFONTAINE, M.-C. TOCZEK

STE 2020

1st International Conference on Science
and Technology Education

15-16 October 2020 · FEUP, Porto - Portugal



The popularity of blended learning is growing at the university

- Integral part of our personal and professional lives
- Could even be considered as the norm
- Flexibility in time and space

(Al-Qahtani & Higgins, 2013; Deschacht & Goeman, 2015; Huang, Lin, & Huang, 2012a; Norberg, Dziuban, & Moskal, 2011)

Blended-learning (BL)

- Refers to many approaches
- Combination of face-to-face instruction with computer-mediated instruction
- These two modes can vary greatly in terms of time, methodology and content

(Boelens, Van Laer, De Wever, & Elen, 2015;
Osguthorpe & Graham, 2003)

Effects of BL

Study	Design and aim	Population	Results
(McCutcheon et al., 2015)	systematic review : online or BL vs. face-to-face learning	nursing education	no difference in performance compared to face-to-face environments
(Vo, Zhu, & Diep, 2017)	meta-analysis : BL vs. classroom instruction	higher education	BL demonstrates a small effect ($g+ = 0.385$, $p < 0.001$) compared to traditional teaching methods. A higher mean effect size was found in STEM disciplines ($g+ = 0.496$).
(Liu et al., 2016)	meta-analysis : BL vs. no intervention and non-BL	Health Professions learners	BL is more effective than or at least as effective as non-blended instruction
(Bernard, Borokhovski, Schmid, Tamim et Abrami, 2014)	meta-analysis : BL vs. classroom instruction	different types of learners	“improvement in achievement related to BL is low but significantly greater than zero”
(Means, Toyama, Murphy et Baki, 2013)	meta-analysis : face-to-face vs. online and BL	K–12 and higher education	BL > f2f & online ($g+ = +0.35$)

A particular component of the BL : quizzes

Variety of forms : optional exercises or quizzes

- (multiple choice questions, true or false, short answer questions etc.)

Allow for formative self-evaluation at different points of the learning process

Can generate the “testing effect” (roediger & karpicke, 2006)

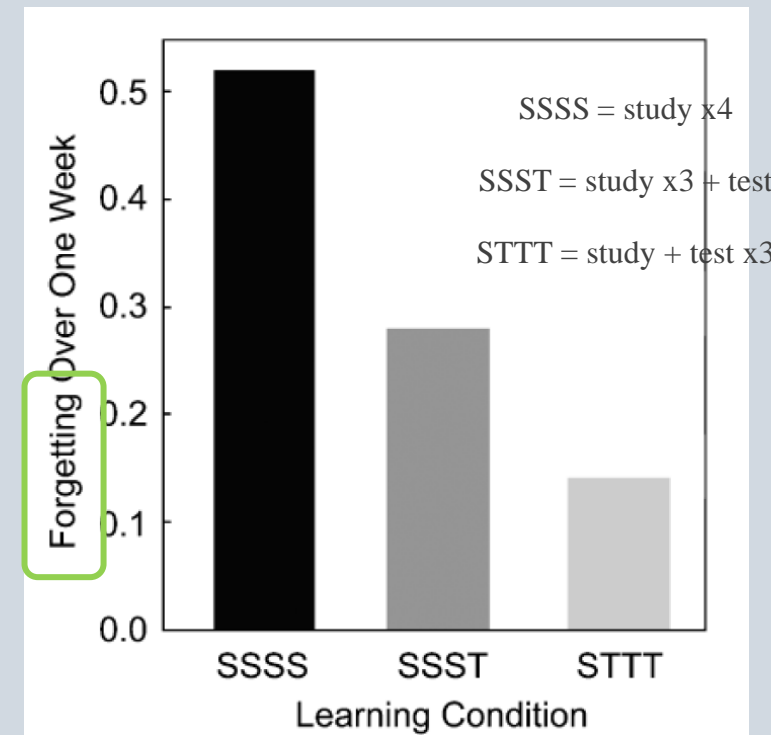
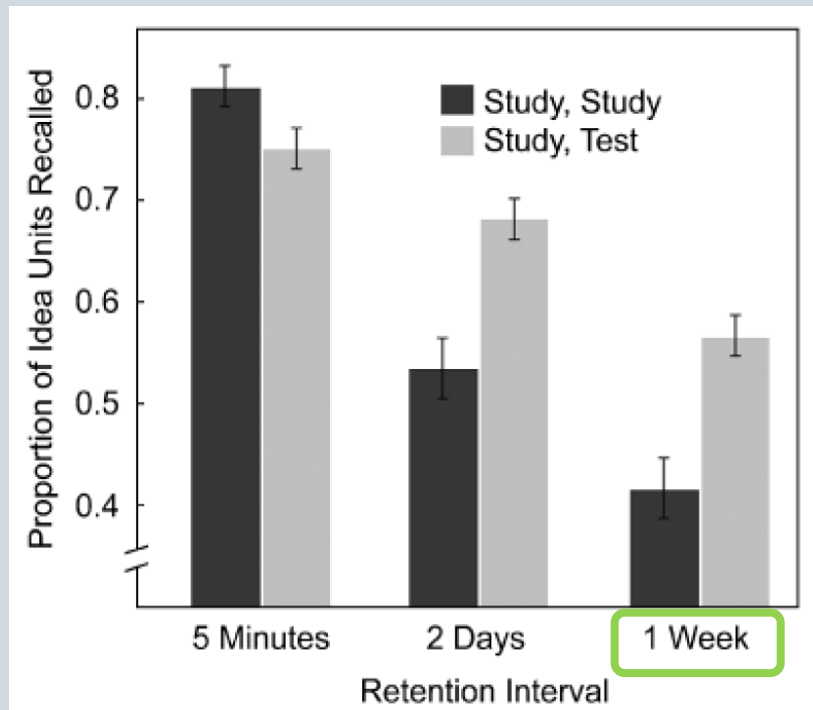
(Al-Qahtani & Higgins, 2013; Botts, Carter, & Crockett, 2018; Delialioglu & Yildirim, 2008; Nicol & Macfarlane-Dick, 2006; Sacré, Toczek & Lafontaine, 2020)

Testing effect

(Agarwal, Karpicke, Kang, Roediger, & McDermott, 2008; Roediger & Karpicke, 2006)

test > restudy

Powerful effects on learning and long-term retention



Research questions

In a context of blended-learning,

- 1) how are quiz scores related to students' performance?
- 2) is this effect different depending on whether the students are
 - low-, medium- or high-achievers?

Two correlational studies were conducted:

- Nursing students (study 1)
- Computer science students (study 2)

Study 1

- Convenience sample
- 80 nursing students
- Course: “Introduction to scientific research methodology”
- One online quiz at the end of the course

Pretest and post-test of performance :

Performance	Min	Max	Mean	SD
Pretest (out of 32)	5.000	26.000	15.023	6.061
Quiz score (out of 20)	.000	18.520	13.445	3.888
Post-test (out of 32)	10.000	32.000	22.587	4.929

Pearson's bivariate correlations

	1	2	3	4	5	6	7
1. Posttest	-						
2. Pretest	,420**	-					
3. Quiz scores	,380**	,295**	-				
4. Gender	-0,176	-0,080	-0,075	-			
5. SEB	0,190	0,150	0,016	0,070	-		
6. Enrolment	-0,099	-0,033	0,113	0,151	-,347**	-	
7. Age	-0,150	0,060	0,165	0,206	-,369**	,864**	-

Results

Linear regression analyzes predicting student performance from their quiz scores and pre-test results :

	B	S.E.	β	P	Adjusted R²
(Constant)	11.982	2.157		.000	.229
Pretest	.375	.115	.339	.002	
Quiz scores	.356	.131	.280	.008	

Dependent Variable: Post-test

- Results show a significant effect of quiz scores on performances, while controlling for the pretest

Study 2

- Convenience sample
- 46 computer science students
- Course: “Mathematics applied to computer graphics”
- Five chapters throughout the semester
- Each chapter included 1 to 5 quizzes and 1 mandatory assessment at the end

Data collection

Independent variable: quiz data (5 averaged quiz scores)

Dependent variable: performance data (5 assessments results)
and sociodemographic variables

Based on the Quiz 1, students were ranked according to their initial level by constituting 3 groups:

- low-, medium- and high-achievers

Data analysis

Firstly, Pearson correlations were calculated between each quiz scores and each performance assessment.

Secondly, we initiated repeated measures correlations to assess the overall relationship between quiz scores and student performance in the course.

(Bakdash & Marusich, 2017)

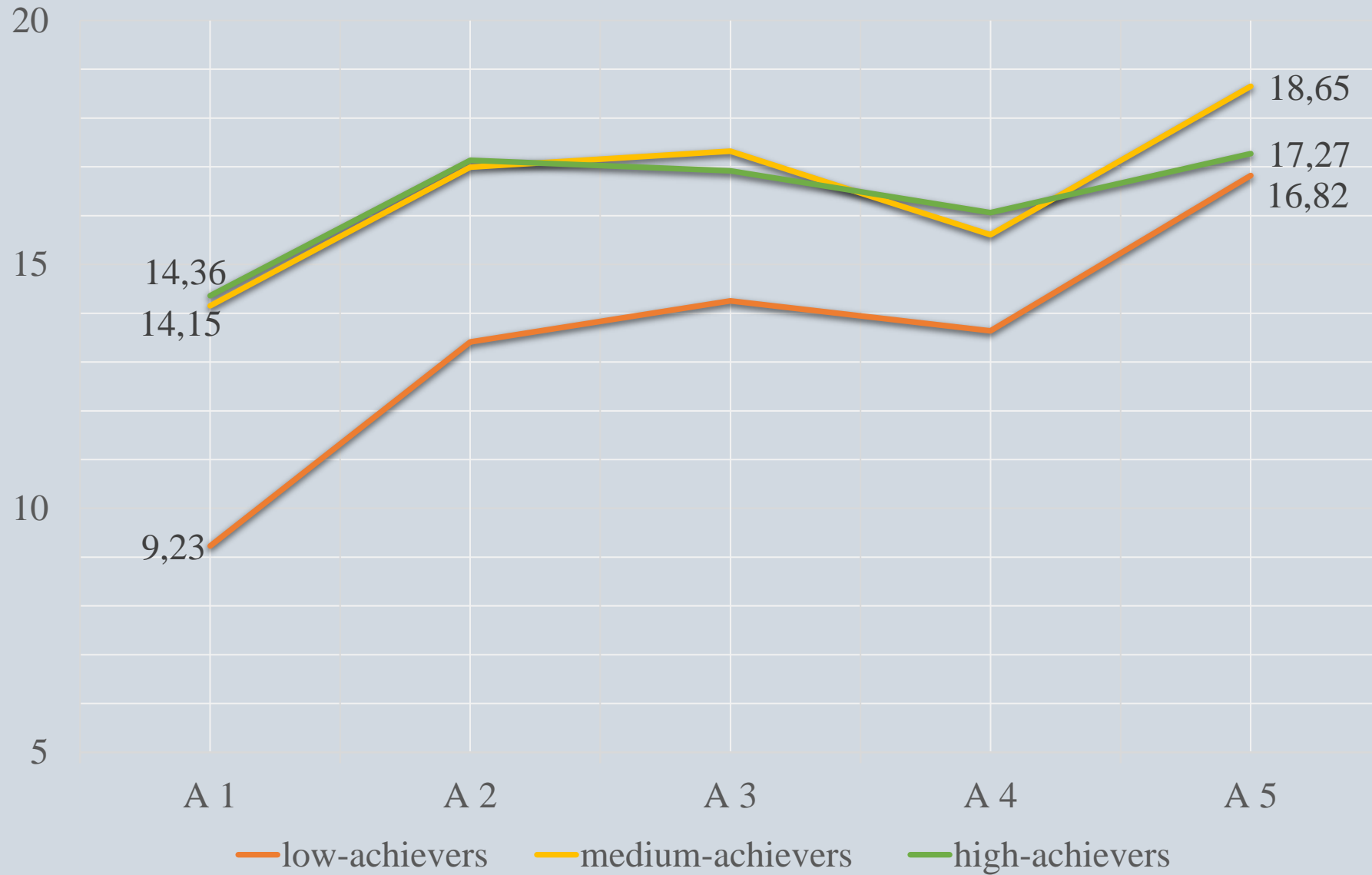
Results

- Pearson's bivariate correlations :

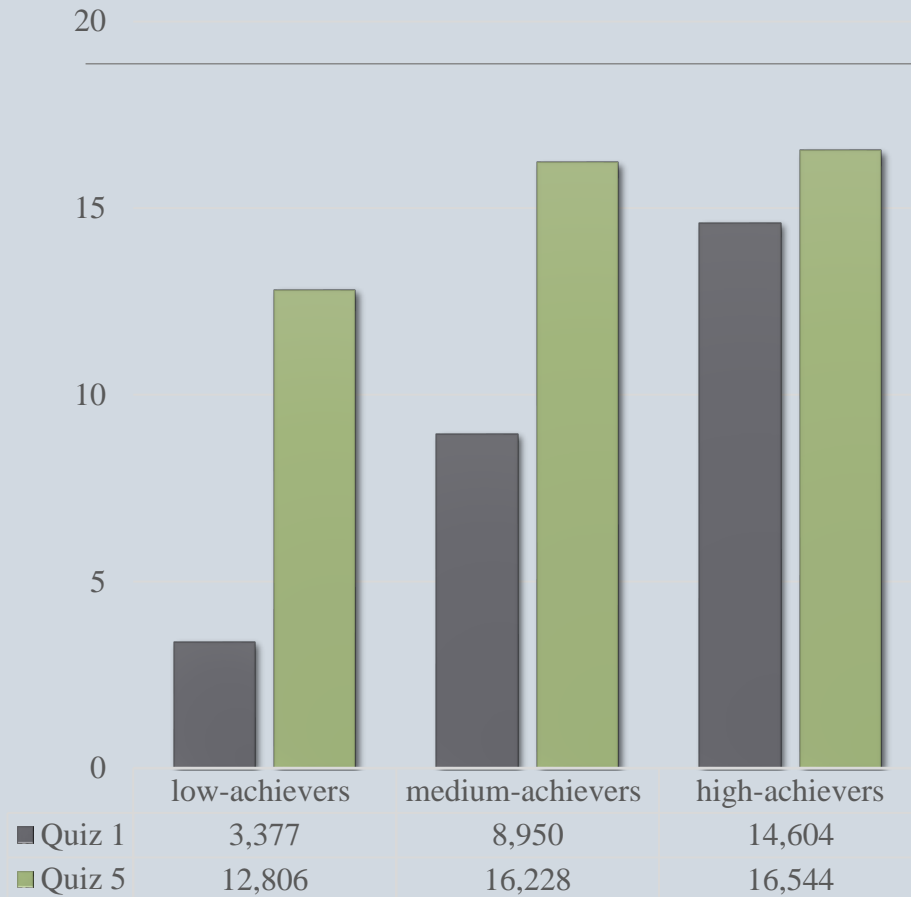
	Assessment 1	Assessment 2	Assessment 3	Assessment 4	Assessment 5
Quiz 1	.439**	.456**	.380*	.148	.158
Quiz 2	.200	.391**	.415**	.265	.092
Quiz 3	.225	.427**	.410**	.298*	.263
Quiz 4	.336*	.086	.268	.470**	.120
Quiz 5	.568**	.233	.178	.371*	.239

- Repeated measures correlations : $r=.332^{**}$

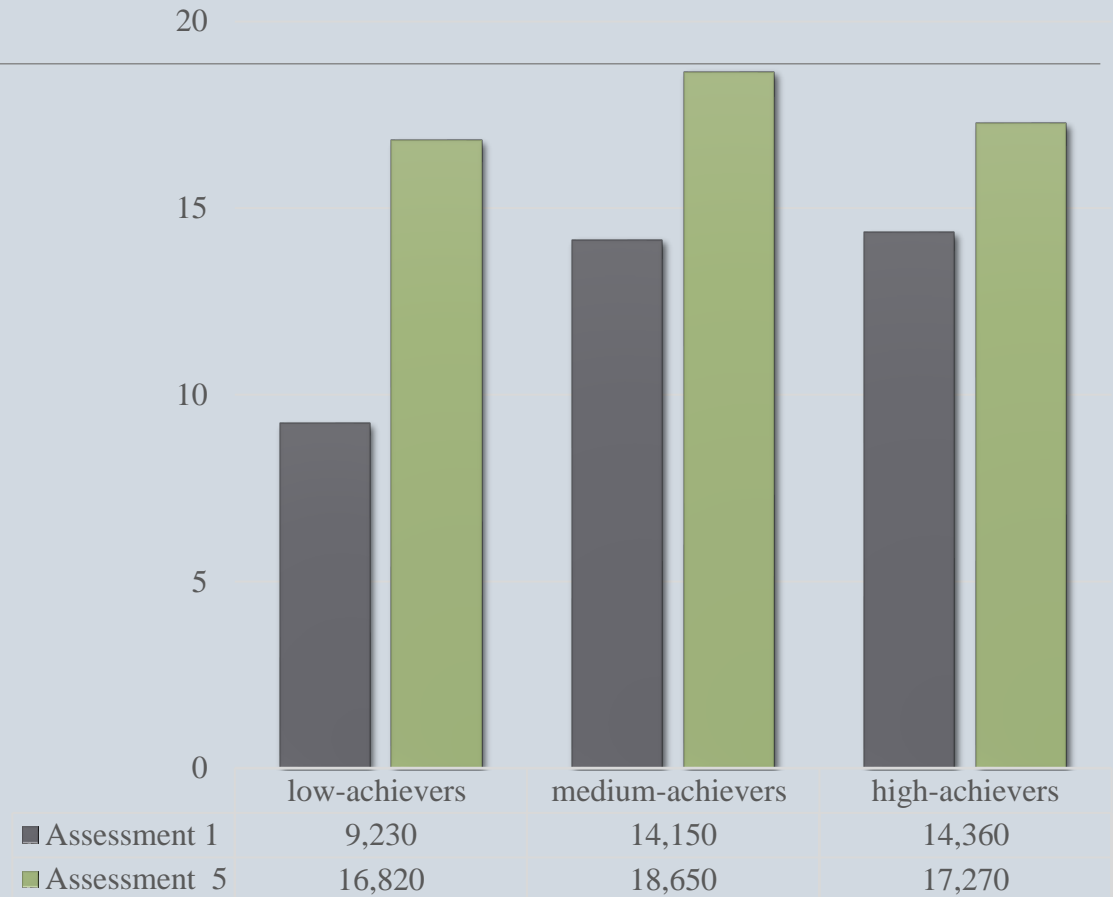
Evolution of students' performance over assessments



Quiz scores by groups from quiz 1 to quiz 5



Assessment results by groups from assessment 1 to assessment 5



Conclusions and limitations

Quiz scores are positively related to student performance

... especially for low-achievers who really benefits from this activity

- This result is quite intuitive: the better they perform, the better they will perform in the future

Could this relation be a consequence of a change in students' motivational beliefs?

(Berger & Büchel, 2012)

Limitations :

- Small samples
- Convenience samples
- Correlational studies
- Very different area

Thank you for your attention

References (1)

- Agarwal, P. K., Karpicke, J. D., Kang, S. H. K., Roediger, H. L., & McDermott, K. B. (2008). Examining the testing effect with open- and closed-book tests. *Applied Cognitive Psychology*, 22(7), 861-876. <https://doi.org/10.1002/acp.1391>
- Al-Qahtani, A. A. Y., & Higgins, S. E. (2013). Effects of traditional, blended and e-learning on students' achievement in higher education. *Journal of Computer Assisted Learning*, 29(3), 220-234. <https://doi.org/10.1111/j.1365-2729.2012.00490.x>
- Bakdash, J. Z., & Marusich, L. R. (2017). Repeated measures correlation. *Frontiers in Psychology*, 8. <https://doi.org/10.3389/fpsyg.2017.00456>
- Berger, J.-L., & Büchel, F. (2012). Métacognition et croyances motivationnelles : Un mariage de raison. *Revue française de pédagogie. Recherches en éducation*, 179, 95-128. <https://doi.org/10.4000/rfp.3705>
- Bernard, R. M., Borokhovski, E., Schmid, R. F., Tamim, R. M., & Abrami, P. C. (2014). A meta-analysis of blended learning and technology use in higher education : From the general to the applied. *Journal of Computing in Higher Education*, 26(1), 87-122. <https://doi.org/10.1007/s12528-013-9077-3>
- Boelens, R., Van Laer, S., De Wever, B., & Elen, J. (2015). *Blended learning in adult education : Towards a definition of blended learning*. <http://hdl.handle.net/1854/LU-6905076>
- Botts, R. T., Carter, L., & Crockett, C. (2018). Using the blended learning approach in a quantitative literacy course. *PRIMUS*, 28(3), 236-265. <https://doi.org/10.1080/10511970.2017.1371264>
- Delialioglu, O., & Yildirim, Z. (2008). Design and development of a technology enhanced hybrid instruction based on MOLTA model : Its effectiveness in comparison to traditional instruction. *Computers & Education*, 51(1), 474-483. aph.
- Deschacht, N., & Goeman, K. (2015). The effect of blended learning on course persistence and performance of adult learners : A difference-in-differences analysis. *Computers & Education*, 87, 83-89. <https://doi.org/10.1016/j.compedu.2015.03.020>

References (2)

- Deschacht, N., & Goeman, K. (2015). The effect of blended learning on course persistence and performance of adult learners : A difference-in-differences analysis. *Computers & Education*, 87, 83-89. <https://doi.org/10.1016/j.compedu.2015.03.020>
- Huang, E. Y., Lin, S. W., & Huang, T. K. (2012). What type of learning style leads to online participation in the mixed-mode e-learning environment? A study of software usage instruction. *Computers & Education*, 58(1), 338-349. <https://doi.org/10.1016/j.compedu.2011.08.003>
- Liu, Q., Peng, W., Zhang, F., Hu, R., Li, Y., & Yan, W. (2016). The Effectiveness of Blended Learning in Health Professions : Systematic Review and Meta-Analysis. *Journal of Medical Internet Research*, 18(1), e2. <https://doi.org/10.2196/jmir.4807>
- McCutcheon, K., Lohan, M., Traynor, M., & Martin, D. (2015). A systematic review evaluating the impact of online or blended learning vs. Face-to-face learning of clinical skills in undergraduate nurse education. *Journal of Advanced Nursing*, 71(2), 255-270. <https://doi.org/10.1111/jan.12509>
- Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning : A model and seven principles of good feedback practice. *Studies in Higher Education*, 31(2), 199-218. <https://doi.org/10.1080/03075070600572090>
- Norberg, A., Dziuban, C. D., & Moskal, P. D. (2011). A time-based blended learning model. *On the Horizon*, 19(3), 207-216. <https://doi.org/10.1108/10748121111163913>
- Osguthorpe, R. T., & Graham, C. R. (2003). Blended learning environments : Definitions and directions. *Quarterly Review of Distance Education*, 4(3), 227-233.
- Roediger, H. L., & Karpicke, J. D. (2006). The power of testing memory : Basic research and implications for educational practice. *Perspectives on Psychological Science*, 1(3), 181-210. <https://doi.org/10.1111/j.1745-6916.2006.00012.x>
- Vo, H. M., Zhu, C., & Diep, N. A. (2017). The effect of blended learning on student performance at course-level in higher education : A meta-analysis. *Studies in Educational Evaluation*, 53, 17-28. <https://doi.org/10.1016/j.stueduc.2017.01.002>