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Assessment and learning engagement in massive open online courses

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References

Abbakumov, D., Desmet, P., & Van den Noortgate, W. (2020). Rasch model extensions for enhanced formative assessments in MOOCs. *Applied Measurement in Education*, *33*(2), 113-123. https://doi.org/10.1080/08957347.2020.1732382

Admiraal, W., Huisman, B., & Pilli, O. (2015). Assessment in massive open online courses. *Electronic Journal of E-learning*, *13*(4), 207-216. Retrieved from https://academic-publishing.org/index.php/ejel/article/view/1728/1691

Admiraal, W., Louws, M., Lockhorst, D., Paas, T., Buynsters, M., Cviko, A., Janssen, C., de Jonge, M., Nouwens, S., & Post, L. (2017). Teachers in school-based technology innovations: A typology of their beliefs on teaching and technology. *Computers & Education*, *114*, 57-68. https://doi.org/10.1016/j.compedu.2017.06.013

Admiraal, W. F., Lockhorst, D., Wubbels, T., Korthagen, F. A., & Veen, W. (1998). Computer-mediated communication environments in teacher education: Computer conferencing and the supervision of student teachers. *Learning Environments Research*, *1*, 59-74. https://doi.org/10.1023/A:1009936715640

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In Kuhl, J., Beckmann, J. (Eds.), *Action control*, 11-39. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-69746-3_2

Al-Rahmi, W. M., Yahaya, N., Alamri, M. M., Alyoussef, I. Y., Al-Rahmi, A. M., & Kamin, Y. B. (2019). Integrating innovation diffusion theory with technology acceptance model: Supporting students' attitude towards using a massive open online courses (MOOCs) systems. *Interactive Learning Environments*, 1-13. https://doi.org/10.1080/10494820.2019.1629599

Alario-Hoyos, C., Pérez-Sanagustín, M., Delgado-Kloos, C., & Munoz-Organero, M. (2014). Delving into participants' profiles and use of social tools in MOOCs. *Ieee Transactions on Learning Technologies*, *7*(3), 260-266. https://doi.org/10.1109/TLT.2014.2311807

Albelbisi, N., Yusop, F. D., & Salleh, U. K. M. (2018). Mapping the factors influencing success of massive open online courses (MOOC) in higher education. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(7), 2995-3012. https://doi.org/10.29333/ejmste/91486

Albelbisi, N. A. (2020). Development and validation of the MOOC success scale (MOOC-SS). *Education and Information Technologies*, *25*(5), 4535-4555. https://doi.org/10.1007/s10639-020-10186-4

Albelbisi, N. A., & Yusop, F. D. (2019). Factors influencing learners' self–regulated learning skills in a massive open online course (MOOC) environment. *Turkish Online Journal of Distance Education*, *20*(3), 1-16. https://doi.org/10.17718/tojde.598191

Alexandron, G., Wiltrout, M. E., Berg, A., & Ruipérez-Valiente, J. A. (2020, March 23-27). Assessment that matters: Balancing reliability and learner-centered pedagogy in MOOC assessment. *Proceedings of the Tenth International Conference on Learning Analytics & Knowledge*, 512-517. Frankfurt, Germany. https://doi.org/10.1145/3375462.3375464

Almatrafi, O., & Johri, A. (2018). Systematic review of discussion forums in massive open online courses (MOOCs). *IEEE Transactions on Learning Technologies*, *12*(3), 413-428. https://doi.org/10.1109/TLT.2018.2859304

Almeda, M. V., Zuech, J., Baker, R.S., Utz, C., Higgins, G., & Reynolds, R. (2018). Comparing the factors that predict completion and grades among for-credit and open/MOOC students in online learning. *Online Learning*, *22*(1), 1-18. https://doi.org/10.24059/olj.v22i1.1060

Altalhi, M. M. (2021). Towards understanding the students' acceptance of MOOCs: A unified theory of acceptance and use of technology (UTAUT). *International Journal of Emerging Technologies in Learning (iJET)*, *16*(2), 237-253. https://doi.org/10.3991/ijet.v16i02.13639

Anne Clark, R. (2002). Learning outcomes: The bottom line. *Communication Education*, *51*(4), 396-404. https://doi.org/10.1080/03634520216531

Artino, A. R. (2008). Motivational beliefs and perceptions of instructional quality: Predicting satisfaction with online training. *Journal of Computer Assisted Learning*, *24*(3), 260-270. https://doi.org/10.1111/j.1365-2729.2007.00258.x

Artino, A. R. (2009). Think, feel, act: Motivational and emotional influences on military students' online academic success. *Journal of computing in higher education*, *21*(2), 146-166. https://doi.org/10.1007/s12528-009-9020-9

Badali, M., Hatami, J., Banihashem, S. K., Rahimi, E., Noroozi, O., & Eslami, Z. (2022). The role of motivation in MOOCs' retention rates: a systematic literature review. *Research and Practice in Technology Enhanced Learning*, *17*(1), 5. https://doi.org/10.1186/s41039-022-00181-3

Balint, T. A., Teodorescu, R., Colvin, K., Choi, Y.-J., & Pritchard, D. (2017). Physics instructional resource usage by high-, medium-, and low-skilled MOOC students. *The Physics Teacher*, *55*(4), 222-225. https://doi.org/10.1119/1.4978719

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191-215. https://psycnet.apa.org/doi/10.1037/0033-295X.84.2.191

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational psychologist*, *28*(2), 117-148. https://doi.org/10.1207/s15326985ep2802_3

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Eds.), *Encyclopedia of human behavior*, *4*, 71-81. Academic Press.

Barak, M., Watted, A., & Haick, H. (2016). Motivation to learn in massive open online courses: Examining aspects of language and social engagement. *Computers & Education*, *94*, 49-60. https://doi.org/10.1016/j.compedu.2015.11.010

Barman, L., Naimi-Akbar, I., & Jansson, M. (2019, October 16-19). Reframing the design for learning in MOOCs. *Proceedings of the 2019 IEEE Frontiers in Education Conference*, 1-7. Covington, United States. https://doi.org/10.1109/FIE43999.2019.9028428

Baturay, M. H. (2015). An overview of the world of MOOCs. *Procedia-Social and Behavioral Sciences*, *174*, 427-433. https://doi.org/10.1016/j.sbspro.2015.01.685

Behling, O., & Law, K. S. (2000). *Translating questionnaires and other research instruments: Problems and solutions*. Sage.

Bell, F. (2011). Connectivism: Its place in theory-informed research and innovation in technology-enabled learning. *International Review of Research in Open and Distributed Learning*, *12*(3), 98-118. https://doi.org/10.19173/irrodl.v12i3.902

Berge, Z. L. (1995). The role of the online instructor/facilitator. *Educational technology*, *35*(1), 22-30. Retrieved from https://trainingthetrainers2010.pbworks.com/f/The+Role+of +the+Online+Instructor.pdf

Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher education*, *32*(3), 347-364. https://doi.org/10.1007/BF00138871

Biggs, J. (1999). What the student does: Teaching for enhanced learning. *Higher education research & development*, *18*(1), 57-75. https://doi.org/10.1080/0729436990180105

Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in Open and Distributed Learning*, *13*(1), 56-71. https://doi.org/10.19173/irrodl.v13i1.1076

Bloom Benjamin, S. (1956). *Taxonomy of Educational Objectives. Handbook I: Cognitive Domain*. David McKay Company.

Bonafini, F., Chae, C., Park, E., & Jablokow, K. (2017). How much does student engagement with videos and forums in a MOOC affect their achievement? *Online Learning Journal*, *21*(4), 223-240. https://doi.org/10.24059/olj.v21i4.1270

Bonafini, F. C. (2017). The effects of participants' engagement with videos and forums in a MOOC for teachers' professional development. *Open Praxis*, *9*(4), 433-447. https://doi.org/10.5944/openpraxis.9.4.637

Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. *International Journal of Educational Technology in Higher Education*, *17*(1), 1-30. https://doi.org/10.1186/s41239-019-0176-8

Bralić, A., & Divjak, B. (2018). Integrating MOOCs in traditionally taught courses: achieving learning outcomes with blended learning. *International Journal of Educational Technology in Higher Education*, *15*(1), 2. https://doi.org/10.1186/s41239-017-0085-7

Brislin, R. W. (1986). The wording and translation of research instruments. In W. J. Lonner & J. W. Berry (Eds.), *Field methods in cross-cultural research*,137-164). Sage Publications, Inc.

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review. *The Internet and Higher Education*, *27*, 1-13. https://doi.org/10.1016/j.iheduc.2015.04.007

Brooker, A., Corrin, L., De Barba, P., Lodge, J., & Kennedy, G. (2018). A tale of two MOOCs: How student motivation and participation predict learning outcomes in different MOOCs. *Australasian Journal of Educational Technology*, *34*(1). https://doi.org/10.14742/ajet.3237

Brophy, J. (2000). *Teaching. Educational Practices. Series 1.* International Buero of Education,

Büchele, S. (2021). Evaluating the link between attendance and performance in higher education: the role of classroom engagement dimensions. *Assessment & Evaluation in Higher Education*, *46*(1), 132-150. https://doi.org/10.1080/02602938.2020.1754330

Buhr, E. E., Daniels, L. M., & Goegan, L. D. (2019). Cognitive appraisals mediate relationships between two basic psychological needs and emotions in a massive open online course. *Computers in Human Behavior*, *96*, 85-94. https://doi.org/10.1016/j.chb.2019.02.009

Cagiltay, N. E., Cagiltay, K., & Celik, B. (2020). An analysis of course characteristics, learner characteristics, and certification rates in MITx MOOCs. *International Review of Research in Open and Distributed Learning*, *21*(3), 121-139. https://doi.org/10.19173/irrodl.v21i3.4698

Camarata, T., & Slieman, T. A. (2020). Improving student feedback quality: A simple model using peer review and feedback rubrics. *Journal of medical education and curricular development*, *7*. https://doi.org/10.1177/2382120520936604

Celik, B., & Cagiltay, K. (2024). Uncovering MOOC completion: A comparative study of completion rates from different perspectives. *Open Praxis*, *16*(3), 445-456. https://doi.org/10.55982/openpraxis.16.3.606

Chang, J. J., Lin, W. S., & Chen, H. R. (2019). How attention level and cognitive style affect learning in a MOOC environment? Based on the perspective of brainwave analysis. *Computers in Human Behavior*, *100*, 209-217. https://doi.org/10.1016/j.chb.2018.08.016

Chauhan, A. (2014). Massive open online courses (MOOCS): Emerging trends in assessment and accreditation. *Digital Education Review*(25), 7-17. Retrieved from https://revistes.ub.edu/index.php/der/article/view/11325/pdf

Chen, G., Lo, C. K., & Hu, L. (2020). Sustaining online academic discussions: Identifying the characteristics of messages that receive responses. *Computers & Education*, *156*, 103938. https://doi.org/10.1016/j.compedu.2020.103938

Chen, M., Wang, X., Wang, J., Zuo, C., Tian, J., & Cui, Y. (2021). Factors affecting college students' continuous intention to use online course platform. *SN Computer Science*, *2*(2), 1-11. https://doi.org/10.1007/s42979-021-00498-8

Chen, Y. H., & Chen, P. J. (2015). MOOC study group: Facilitation strategies, influential factors, and student perceived gains. *Computers & Education*, *86*, 55-70. https://doi.org/10.1016/j.compedu.2015.03.008

Chen, Z., Alcorn, B., Christensen, G., Eriksson, N., Koller, D., & Emanuel, E. (2015). Who's benefiting from MOOCs, and why. *Harvard Business Review*, *22*. https://hbr.org/2015/09/whos-benefiting-from-moocs-and-why

Cheng, G., & Chau, J. (2013). Exploring the relationship between students' self-regulated learning ability and their ePortfolio achievement. *The Internet and Higher Education*, *17*, 9-15. https://doi.org/10.1016/j.iheduc.2012.09.005

Cheng, H. F., Yu, B., Fu, S., Zhao, J., Hecht, B., Konstan, J., Terveen, L., Yarosh, S., & Zhu, H. (2019, June 24-25). Teaching UI design at global scales: A case study of the design of collaborative capstone projects for MOOCs. *Proceedings of the Sixth (2019) ACM Conference on Learning @ Scale*, 1-11. Chicago, United States. https://doi.org/10.1145/3330430.3333635

Chi, M. T. (2009). Active-constructive-interactive: A conceptual framework for differentiating learning activities. *Topics in cognitive science*, *1*(1), 73-105. https://doi.org/10.1111/j.1756-8765.2008.01005.x

Chi, M. T., Adams, J., Bogusch, E. B., Bruchok, C., Kang, S., Lancaster, M., Levy, R., Li, N., McEldoon, K. L., & Stump, G. S. (2018). Translating the ICAP theory of cognitive engagement into practice. *Cognitive science*, *42*(6), 1777-1832. https://doi.org/10.1111/cogs.12626

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational psychologist*, *49*(4), 219-243. https://doi.org/10.1080/00461520.2014.965823

Chiu, T. K. F., & Hew, T. K. F. (2018). Factors influencing peer learning and performance in MOOC asynchronous online discussion forum. *Australasian Journal of Educational Technology*, *34*(4), 16. https://doi.org/10.14742/ajet.3240

Comer, D. (2017). Learning transfer, feedback, and massive open online courses. *Journal of Systemics, Cybernetics and Informatics*, *15* ((1)), 44-52. Retrieved from https://www.iiisci.org/Journal/pdv/sci/pdfs/SA611XH16.pdf

Conijn, R., Van Den Beemt, A., & Cuijpers, P. (2018). Predicting student performance in a blended MOOC. *Journal of Computer Assisted Learning*, *34*(5), 615-628. https://doi.org/10.1111/jcal.12270

Coudevylle, G. R., Boulley-Escriva, G., Finez, L., Eugène, K., & Robin, N. (2020). An experimental investigation of claimed self-handicapping strategies across motivational climates based on achievement goal and self-determination theories. *Educational Psychology*, *40*(8), 1002-1021. https://doi.org/10.1080/01443410.2020.1746237

Crossley, S., Paquette, L., Dascalu, M., McNamara, D. S., & Baker, R. S. (2016, April 25-29). Combining click-stream data with NLP tools to better understand MOOC completion. *Proceedings of the sixth international conference on learning analytics & knowledge*, 6-14. Edinburgh, United Kingdom. https://doi.org/10.1145/2883851.2883931

Dale, V. H., & Singer, J. (2019). Learner experiences of a blended course incorporating a MOOC on Haskell functional programming. *Research in Learning Technology*, *27*. https://doi.org/10.25304/rlt.v27.2248

Dalipi, F., Imran, A. S., & Kastrati, Z. (2018, April 17-20). MOOC dropout prediction using machine learning techniques: Review and research challenges. *2018 IEEE global engineering education conference (EDUCON)*, 1007-1014. Santa Cruz de Tenerife, Spain. https://doi.org/10.1109/EDUCON.2018.8363340

Dandache, S., Frenay, M., Van Nes, M.-C., & Verschuren, F. (2017). A massive open online course (MOOC) for implementing pedagogical tools in undergraduate respiratory physiology. *HAPS Educator*, *21*(2), 36. https://doi.org/10.21692/haps.2017.013

Day, I. N., van Blankenstein, F. M., Westenberg, M., & Admiraal, W. (2018). A review of the characteristics of intermediate assessment and their relationship with student grades. *Assessment & Evaluation in Higher Education*, *43*(6), 908-929. https://doi.org/10.1080/02602938.2017.1417974

De Freitas, S. I., Morgan, J., & Gibson, D. (2015). Will MOOCs transform learning and teaching in higher education? Engagement and course retention in online learning provision. *British Journal of Educational Technology*, *46*(3), 455-471. https://doi.org/10.1111/bjet.12268

de Lima, M., & Zorrilla, M. E. (2017). Social networks and the building of learning communities: An experimental study of a social MOOC. *International Review of Research in Open and Distributed Learning*, *18*(1), 40-64. https://doi.org/10.19173/irrodl.v18i1.2630

DeBoer, J., Haney, C., Atiq, S. Z., Smith, C., & Cox, D. (2019). Hands-on engagement online: using a randomised control trial to estimate the impact of an at-home lab kit on student

attitudes and achievement in a MOOC. *European Journal of Engineering Education*, *44*(1-2), 234-252. https://doi.org/10.1080/03043797.2017.1378170

Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: the self-determination theory perspective. *Journal of Personality*, *62*(1), 119-134. https://doi.org/10.1111/j.1467-6494.1994.tb00797.x

Deci, E. L., & Ryan, R. M. (1985a). The general causality orientations scale: Self-determination in personality. *Journal of research in personality*, *19*(2), 109-134. https://doi.org/10.1016/0092-6566(85)90023-6

Deci, E. L., & Ryan, R. M. (1985b). *Intrinsic motivation and self-determination in human behaviour*. Plenum.

Deci, E. L., & Ryan, R. M. (1985c). *Motivation and self-determination in human behavior*. Plenum.

Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of personality and social psychology*, *53*(6), 1024-1037. https://doi.org/10.1037//0022-3514.53.6.1024

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry*, *11*(4), 227-268. https://doi.org/10.1207/S15327965PLI1104_01

Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian psychology/Psychologie canadienne*, *49*(1), 14-23. https://doi.org/10.1037/0708-5591.49.1.14

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational psychologist*, *26*(3-4), 325-346. https://doi.org/10.1080/00461520.1991.9653137

del Mar Sánchez-Vera, M., & Prendes-Espinosa, M. P. (2015). Beyond objective testing and peer assessment: alternative ways of assessment in MOOCs. *International Journal of Educational Technology in Higher Education*, *12*(1), 119-130. https://doi.org/10.7238/rusc.v12i1.2262

Deng, R., Benckendorff, P., & Gannaway, D. (2019). Progress and new directions for teaching and learning in MOOCs. *Computers & Education*, *129*, 48-60. https://doi.org/10.1016/j.compedu.2018.10.019

Deng, R., Benckendorff, P., & Gannaway, D. (2020a). Learner engagement in MOOCs: Scale development and validation. *British Journal of Educational Technology*, *51*(1), 245-262. https://doi.org/10.1111/bjet.12810

Deng, R., Benckendorff, P., & Gannaway, D. (2020b). Linking learner factors, teaching context, and engagement patterns with MOOC learning outcomes. *Journal of Computer Assisted Learning*. https://doi.org/10.1111/jcal.12437

Downes, S. (2008). Places to go: Connectivism & connective knowledge. *Innovate: Journal of Online Education*, *5*(1), 6. Retrieved from https://nsuworks.nova.edu/innovate/vol5/iss1/6

Duan, J., Xie, K., Hawk, N. A., Yu, S., & Wang, M. (2019). Exploring a personal social knowledge network (PSKN) to aid the observation of connectivist interaction for high- and low-performing learners in connectivist massive open online courses. *British Journal of Educational Technology*, *50*(1), 199-217.

https://doi.org/10.1111/bjet.12687

Ebben, M., & Murphy, J. S. (2014). Unpacking MOOC scholarly discourse: a review of nascent MOOC scholarship. *Learning, Media and Technology*, *39*(3), 328-345. https://doi.org/10.1080/17439884.2013.878352

Eccles, J., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J., and Midgley, C. (1983). Expectancies, values and academic behaviors. In J. T. Spence (Eds.), *Achievement and achievement motives*, 75-146. Freeman.

Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. *Contemporary Educational Psychology*, *61*, 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

Eccleston, C., Doherty, K., Bindoff, A., Robinson, A., Vickers, J., & McInerney, F. (2019). Building dementia knowledge globally through the understanding dementia massive open online course (MOOC). *npj Science of Learning*, *4*(1), 3. https://doi.org/10.1038/s41539-019-0042-4

Edwards, O. V., & Taasoobshirazi, G. (2022). Social presence and teacher involvement: The link with expectancy, task value, and engagement. *The Internet and Higher Education*, 100869. https://doi.org/10.1016/j.iheduc.2022.100869

Elizondo-Garcia, J., & Gallardo, K. (2020). Peer feedback in learner-learner interaction practices. Mixed Methods Study on an xMOOC. *Electronic Journal of E-learning*, *18*(2), 122-135. https://doi.org/10.34190/EJEL.20.18.2.002

Emanuel, J. P., & Lamb, A. (2017). Open, online, and blended: Transactional interactions with MOOC content by learners in three different course formats. *Online Learning*, *21*(2), n2. https://dx.doi.org/10.2139/ssrn.2666657

Ewais, A., Awad, M., & Hadia, K. (2020). Aligning learning materials and assessment with course learning outcomes in MOOCs using data mining techniques. In Hatzilygeroudis, I., Perikos, I., Grivokostopoulou, F. (Eds) *Advances in Integrations of Intelligent Methods. Smart Innovation, Systems and Technologies*, 170, 1-25. Springer, Singapore. https://doi.org/10.1007/978-981-15-1918-5_1

Farrow, E., Moore, J., & Gašević, D. (2022). Markers of cognitive quality in student contributions to online course discussion forums. *Journal of Learning Analytics*, *9*(2), 38-65. https://doi.org/10.18608/jla.2022.7250

Fávero, L. P., Hair Jr, J. F., Souza, R. d. F., Albergaria, M., & Brugni, T. V. (2021). Zero-inflated generalized linear mixed models: A better way to understand data relationships. *Mathematics*, *9*(10), 1100. https://doi.org/10.3390/math9101100

Ferguson, E., & Cox, T. (1993). Exploratory factor analysis: A users' guide. *International journal of selection and assessment*, *1*(2), 84-94. https://doi.org/10.1111/j.1468-2389.1993.tb00092.x

Flake, J. K., Barron, K. E., Hulleman, C., McCoach, B. D., & Welsh, M. E. (2015). Measuring cost: The forgotten component of expectancy-value theory. *Contemporary Educational Psychology*, *41*, 232-244. https://doi.org/10.1016/j.cedpsych.2015.03.002

Formanek, M., Wenger, M. C., Buxner, S. R., Impey, C. D., & Sonam, T. (2017). Insights about large-scale online peer assessment from an analysis of an astronomy MOOC. *Computers & Education*, *113*, 243-262. https://doi.org/10.1016/j.compedu.2017.05.019

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, *18*(1), 39-50. https://doi.org/10.1177/002224378101800104

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of educational research*, *74*(1), 59-109. https://doi.org/10.3102/00346543074001059

Fryer, L. K., & Ainley, M. (2019). Supporting interest in a study domain: A longitudinal test of the interplay between interest, utility-value, and competence beliefs. *Learning and Instruction*, *60*, 252-262. https://doi.org/10.1016/j.learninstruc.2017.11.002

Galikyan, I., Admiraal, W., & Kester, L. (2021). MOOC discussion forums: The interplay of the cognitive and the social. *Computers & Education*, *165*, 104133. https://doi.org/10.1016/j.compedu.2021.104133

Garay, A. M., Hashimoto, E. M., Ortega, E. M., & Lachos, V. H. (2011). On estimation and influence diagnostics for zero-inflated negative binomial regression models. *Computational Statistics & Data Analysis*, *55*(3), 1304-1318. https://doi.org/10.1016/j.csda.2010.09.019

Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, *2*(2-3), 87-105. https://doi.org/10.1016/S1096-7516(00)00016-6

Garver, M. S., & Mentzer, J. T. (1999). Logistics research methods: employing structural equation modeling to test for construct validity. *Journal of business logistics*, *20*(1), 33. Retrieved from https://www.proquest.com/scholarly-journals/logistics-research-methods-employing-structural/docview/212605730/se-2

Ghazali, N., Nordin, M. S., Abdullah, A., & Ayub, A. F. M. (2020). The relationship between students' MOOC-efficacy and meaningful learning. *Asian Journal of University Education*, *16*(3), 89-101. Retrieved from https://files.eric.ed.gov/fulltext/EJ1274304.pdf

Gillani, N., & Eynon, R. (2014). Communication patterns in massively open online courses. *The Internet and Higher Education*, *23*, 18-26. https://doi.org/10.1016/j.iheduc.2014.05.004

Goggins, S. P., Galyen, K., Petakovic, E., & Laffey, J. M. (2016). Connecting performance to social structure and pedagogy as a pathway to scaling learning analytics in MOOCs: An exploratory study. *Journal of Computer Assisted Learning*, *32*(3), 244-266. https://doi.org/10.1111/jcal.12129

Gorgun, G., Yildirim-Erbasli, S. N., & Epp, C. D. (2022). Predicting cognitive engagement in online course discussion forums. *Proceedings of the 15th International Conference on Educational Data Mining, 53*(60), 61-62. https://doi.org/10.5281/zenodo.6853149

Guo, J., Parker, P. D., Marsh, H. W., & Morin, A. J. (2015). Achievement, motivation, and educational choices: A longitudinal study of expectancy and value using a multiplicative perspective. *Developmental psychology*, *51*(8), 1163. https://doi.org/10.1037/a0039440

Handoko, E., Gronseth, S. L., McNeil, S. G., Bonk, C. J., & Robin, B. R. (2019). Goal setting and MOOC completion: A study on the role of self-regulated learning in student

performance in massive open online courses. *International Review of Research in Open and Distributed Learning*, *20*(3). https://doi.org/10.19173/irrodl.v20i4.4270

Harvey, L. A., Glinsky, J. V., Muldoon, S., & Chhabra, H. S. (2017). Massive open online courses for educating physiotherapists about spinal cord injuries: a descriptive study. *Spinal cord series and cases*, *3*, 17005. https://doi.org/10.1038/scsandc.2017.5

Haw, J. Y., & King, R. B. (2023). Perceived need-supportive leadership, perceived need-supportive teaching, and student engagement: A self-determination perspective. *Social Psychology of Education*, *26*(5), 1289-1319. https://doi.org/10.1007/s11218-023-09790-2

Hayes, A. F., & Little, T. D. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach (2nd ed.)*. Guilford publications.

Haythornthwaite, C. (1996). Social network analysis: An approach and technique for the study of information exchange. *Library & information science research*, *18*(4), 323-342. https://doi.org/10.1016/S0740-8188(96)90003-1

Haythornthwaite, C., & De Laat, M. (2012). Social network informed design for learning with educational technology. In A. Olofsson & J. Lindberg (Eds.), *Informed design of educational technologies in higher education: Enhanced learning and teaching,* 352-374. IGI Global Scientific Publishing. https://doi.org/10.4018/978-1-61350-080-4.ch018

He, C., Ma, P., Zhou, L., & Wu, J. (2018). Is participating in MOOC forums important for students? A data-driven study from the perspective of the supernetwork. *Journal of Data and Information Science*, *3*(2), 62-77. https://doi.org/10.2478/jdis-2018-0009

Hecking, T., Chounta, I. A., & Hoppe, H. U. (2017). Role modelling in MOOC discussion forums. *Journal of Learning Analytics*, *4*(1), 85-116. https://doi.org/10.18608/jla.2017.41.6

Henderikx, M. A., Kreijns, K., & Kalz, M. (2017). Refining success and dropout in massive open online courses based on the intention-behavior gap. *Distance Education*, *38*(3), 353-368. https://doi.org/10.1080/01587919.2017.1369006

Hendriks, R. A., de Jong, P. G., Admiraal, W. F., & Reinders, M. E. (2020). Instructional design quality in medical massive open online courses for integration into campus education. *Medical teacher*, *42*(2), 156-163. https://doi.org/10.1080/0142159X.2019.1665634

Hendriks, R. A., de Jong, P. G., Admiraal, W. F., & Reinders, M. E. (2024). Motivation for learning in campus-integrated MOOCs: Self-determined students, grade hunters and teacher trusters. *Computers and Education Open*, *6*, 100158. https://doi.org/10.1016/j.caeo.2023.100158

Henri, F. (1992). Computer Conferencing and Content Analysis. In Kaye, A. R. (Eds.), *Collaborative Learning Through Computer Conferencing*: *The Najaden papers*, *90*, 117-136. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-77684-7_8

Hew, K. F. (2016). Promoting engagement in online courses: What strategies can we learn from three highly rated MOOCS. *British Journal of Educational Technology*, *47*(2), 320-341. https://doi.org/10.1111/bjet.12235

Hew, K. F., Hu, X., Qiao, C., & Tang, Y. (2020). What predicts student satisfaction with MOOCs: A gradient boosting trees supervised machine learning and sentiment analysis approach. *Computers & Education*, *145*, 103724.

https://doi.org/10.1016/j.compedu.2019.103724

Hilbe, J. M. (2011). *Negative binomial regression (2nd edition)*. Cambridge University Press.

Hood, N., & Littlejohn, A. (2016a). MOOC Quality: the need for new measures. *Journal of Learning for Development*, *3*(3), 28-42. https://doi.org/10.56059/jl4d.v3i3.165

Hood, N., & Littlejohn, A. (2016b). Quality in MOOCs: Surveying the terrain. Commonwealth of Learning. Retrieved from https://oro.open.ac.uk/50931/1/2015_QualityinMOOCs-Surveying-the-Terrain.pdf

Houston, S. L., Brady, K., Narasimham, G., & Fisher, D. (2017). Pass the idea please: The relationship between network position, direct engagement, and course performance in MOOCs. *Proceedings of the Fourth (2017) ACM Conference on Learning @ Scale, 295-298*. https://doi.org/10.1145/3051457.3054008

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, *15*(9), 1277-1288. https://doi.org/10.1177/1049732305276687

Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, *6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Hudson, L., Wolff, A., Gooch, D., Van Der Linden, J., Kortuem, G., Petre, M., ten Veen, R., & O'Connor-Gotra, S. (2019). Supporting urban change: Using a MOOC to facilitate attitudinal learning and participation in smart cities. *Computers & Education*, *129*, 37-47. https://doi.org/10.1016/j.compedu.2018.10.012

Huisman, B., Admiraal, W., Pilli, O., van de Ven, M., & Saab, N. (2018). Peer assessment in MOOCs: The relationship between peer reviewers' ability and authors' essay performance. *British Journal of Educational Technology*, *49*(1), 101-110. https://doi.org/10.1111/bjet.12520

Jansen, R. S., van Leeuwen, A., Janssen, J., Conijn, R., & Kester, L. (2020). Supporting learners' self-regulated learning in massive open online courses. *Computers & Education*, *146*, 103771. https://doi.org/10.1016/j.compedu.2019.103771

Jia, M., Gong, D., Luo, J., Zhao, J., Zheng, J., & Li, K. (2019). Who can benefit more from massive open online courses? A prospective cohort study. *Nurse education today*, *76*, 96-102. https://doi.org/10.1016/j.nedt.2019.02.004

Jiang, S., Fitzhugh, S. M., & Warschauer, M. (2014). Social positioning and performance in MOOCs. In *Workshop on Graph-Based Educational Data Mining*, 14. Retrieved from https://ceur-ws.org/Vol-1183/gedm_paper08.pdf

Jiang, Y. (2025). Interaction and dialogue: Integration and application of artificial intelligence in blended mode writing feedback. *The Internet and Higher Education*, 100975. https://doi.org/10.1016/j.iheduc.2024.100975

Joksimović, S., Manataki, A., Gašević, D., Dawson, S., Kovanović, V., & De Kereki, I. F. (2016, April 25-29). Translating network position into performance: Importance of centrality in different network configurations. *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge*, 314-323. Edinburgh, United Kingdom. https://doi.org/10.1145/2883851.2883928

R

Joksimović, S., Poquet, O., Kovanović, V., Dowell, N., Mills, C., Gašević, D., Dawson, S., Graesser, A. C., & Brooks, C. (2018). How do we model learning at scale? A systematic review of research on MOOCs. *Review of educational research*, *88*(1), 43-86. https://doi.org/10.3102/0034654317740335

Joo, Y. J., Lim, K. Y., & Kim, J. (2013). Locus of control, self-efficacy, and task value as predictors of learning outcome in an online university context. *Computers & Education*, *62*, 149-158. https://doi.org/10.1016/j.compedu.2012.10.027

Joo, Y. J., So, H. J., & Kim, N. H. (2018). Examination of relationships among students' self-determination, technology acceptance, satisfaction, and continuance intention to use K-MOOCs. *Computers & Education*, *122*, 260-272. https://doi.org/10.1016/j.compedu.2018.01.003

Jordan, K. (2015). Massive open online course completion rates revisited: Assessment, length and attrition. *International Review of Research in Open and Distributed Learning*, *16*(3), 341-358. https://doi.org/10.19173/irrodl.v16i3.2112

Jung, E., Kim, D., Yoon, M., Park, S., & Oakley, B. (2019). The influence of instructional design on learner control, sense of achievement, and perceived effectiveness in a supersize MOOC course. *Computers & Education*, *128*, 377-388. https://doi.org/10.1016/j.compedu.2018.10.001

Jung, I., & Lee, J. (2020). The effects of learner factors on MOOC learning outcomes and their pathways. *Innovations in Education and Teaching International*, *57*(5), 565-576. https://doi.org/10.1080/14703297.2019.1628800

Jung, Y., & Lee, J. (2018). Learning engagement and persistence in massive open online courses (MOOCS). *Computers & Education*, *122*, 9-22. https://doi.org/10.1016/j.compedu.2018.02.013

Kahan, T., Soffer, T., & Nachmias, R. (2017). Types of participant behavior in a massive open online course. *The International Review of Research in Open and Distributed Learning*, *18*(6), 1-18. https://doi.org/10.19173/irrodl.v18i6.3087

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, *39*(1), 31-36. https://doi.org/10.1007/BF02291575

Kang, I. G. (2020). Heterogeneity of learners' behavioral patterns of watching videos and completing assessments in massive open online courses (MOOCs): A latent class analysis. *International Review of Research in Open and Distributed Learning*, *21*(4), 221-237. https://doi.org/10.19173/irrodl.v21i4.4645

Khalil, M., & Ebner, M. (2017). Clustering patterns of engagement in massive open online courses (MOOCs): The use of learning analytics to reveal student categories. *Journal of computing in higher education*, *29*(1), 114-132. https://doi.org/10.1007/s12528-016-9126-9

Kim, E. (2023, March 18-20). Relevant interaction among learners and instructors in asynchronous academic writing course. *Proceedings of the 11th International Conference on Information and Education Technology (ICIET)*, 298-303. Fujisawa, Japan. https://doi.org/10.1109/ICIET56899.2023.10111158.

Kim, W., Watson, S. L., & Watson, W. R. (2016). Perceived learning in three MOOCs targeting attitudinal change. *Educational Media International*, *53*(3), 168-183. https://doi.org/10.1080/09523987.2016.1236890

Kizilcec, R. F., Pérez-Sanagustín, M., & Maldonado, J. J. (2016, April 25-26). Recommending self-regulated learning strategies does not improve performance in a MOOC. *Proceedings of the Third (2016) ACM Conference on Learning @ Scale*, 101-104. Edinburgh, United Kindom. https://doi.org/10.1145/2876034.2893378

Kizilcec, R. F., Pérez-Sanagustín, M., & Maldonado, J. J. (2017). Self-regulated learning strategies predict learner behavior and goal attainment in massive open online courses. *Computers & Education*, *104*, 18-33. https://doi.org/10.1016/j.compedu.2016.10.001

Kleinberg, J. M. (1999). Authoritative sources in a hyperlinked environment. *Journal of the ACM (JACM)*, *46*(5), 604-632. https://doi.org/10.1145/324133.324140

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford publications.

Kormos, J., & Nijakowska, J. (2017). Inclusive practices in teaching students with dyslexia: Second language teachers' concerns, attitudes and self-efficacy beliefs on a massive open online learning course. *Teaching and Teacher Education*, *68*, 30-41. https://doi.org/10.1016/j.tate.2017.08.005

Kosovich, J. J., Flake, J. K., & Hulleman, C. S. (2017). Short-term motivation trajectories: A parallel process model of expectancy-value. *Contemporary Educational Psychology*, *49*, 130-139. https://doi.org/10.1016/j.cedpsych.2017.01.004

Kovanović, V., Joksimović, S., Poquet, O., Hennis, T., de Vries, P., Hatala, M., Dawson, S., Siemens, G., & Gašević, D. (2019). Examining communities of inquiry in massive open online courses: The role of study strategies. *The Internet and Higher Education*, *40*, 20-43. https://doi.org/10.1016/j.iheduc.2018.09.001

Kraiger, K., Ford, J. K., & Salas, E. (1993). Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. *Journal of applied psychology*, *78*(2), 311-328. https://psycnet.apa.org/doi/10.1037/0021-9010.78.2.311

Krasny, M. E., DuBois, B., Adameit, M., Atiogbe, R., Alfakihuddin, M. L. B., Bold-erdene, T., Golshani, Z., González-González, R., Kimirei, I., & Leung, Y. (2018). Small groups in a social learning MOOC (sIMOOC): Strategies for fostering learning and knowledge creation. *Online Learning*, *22*(2), 119-139. https://doi.org/10.24059/olj.v22i2.1339

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). Taxonomy of educational objectives *Handbook II: Affective domain*,. David McKay Company.

Kuo, T. M. L., Tsai, C. C., & Wang, J. C. (2021). Linking web-based learning self-efficacy and learning engagement in MOOCs: The role of online academic hardiness. *The Internet and Higher Education*, 100819. https://doi.org/10.1016/j.iheduc.2021.100819

Kurucay, M. (2015). *Examining the effects of learner-learner interaction on students' perceptions of collaboration, sense of community, satisfaction, perceived learning and achievement in an online undergraduate course* (Doctoral dissertation, Texas Tech University). TTU Electronic Theses and Dissertations. http://hdl.handle.net/2346/6362

Kurucay, M., & Inan, F. A. (2017). Examining the effects of learner-learner interactions on satisfaction and learning in an online undergraduate course. *Computers & Education*, *115*, 20-37. https://doi.org/10.1016/j.compedu.2017.06.010

Lambert, S. R. (2020). Do MOOCs contribute to student equity and social inclusion? A systematic review 2014-18. *Computers & Education*, *145*, 103693. https://doi.org/10.1016/j.compedu.2019.103693

Lan, M., & Hew, K. F. (2020). Examining learning engagement in MOOCs: A self-determination theoretical perspective using mixed method. *International Journal of Educational Technology in Higher Education*, *17*(1), 1-24. https://doi.org/10.1186/s41239-020-0179-5

Lan, M., Hou, X., Qi, X., & Mattheos, N. (2019). Self-regulated learning strategies in world's first MOOC in implant dentistry. *European Journal of Dental Education*, *23*(3), 278-285. https://doi.org/10.1111/eje.12428

Lee, D., Watson, S. L., & Watson, W. R. (2020a). The influence of successful MOOC learners' self-regulated learning strategies, Self-efficacy, and task value on their perceived effectiveness of a massive open online course. *International Review of Research in Open and Distributed Learning*, *21*(3), 81-98. https://doi.org/10.19173/irrodl.v21i3.4642

Lee, D., Watson, S. L., & Watson, W. R. (2020b). The relationships between self-efficacy, task value, and self-regulated learning strategies in massive open online courses. *International Review of Research in Open and Distributed Learning*, *21*(1), 23-39. https://doi.org/10.19173/irrodl.v20i5.4389

Lee, Y. (2018). Effect of uninterrupted time-on-task on students' success in massive open online courses (MOOCs). *Computers in Human Behavior*, *86*, 174-180. https://doi.org/10.1016/j.chb.2018.04.043

Lee, Y. (2019). Using self-organizing map and clustering to investigate problem-solving patterns in the massive open online course: an exploratory study. *Journal of Educational Computing Research*, *57*(2), 471-490. https://doi.org/10.1177/0735633117753364

Leenknecht, M. J., Wijnia, L., Loyens, S., & Rikers, R. (2017). Need-supportive teaching in higher education: Configurations of autonomy support, structure, and involvement. *Teaching and Teacher Education*, *68*, 134-142. http://dx.doi.org/10.1016/j.tate.2017.08.020

Li, B., Wang, X., & Tan, S. C. (2018). What makes MOOC users persist in completing MOOCs? A perspective from network externalities and human factors. *Computers in Human Behavior*, *85*, 385-395. https://doi.org/10.1016/j.chb.2018.04.028

Li, H., Kim, M. K., & Xiong, Y. (2020). Individual learning vs. interactive learning: A cognitive diagnostic analysis of MOOC students' learning behaviors. *American Journal of distance education*, *34*(2), 121-136. https://doi.org/10.1080/08923647.2019.1697027

Li, K. (2019). MOOC learners' demographics, self-regulated learning strategy, perceived learning and satisfaction: A structural equation modeling approach. *Computers & Education*, *132*, 16-30. https://doi.org/10.1016/j.compedu.2019.01.003

Li, K., & Moore, D. R. (2018). Motivating students in massive open online courses (MOOCs) using the attention, relevance, confidence, satisfaction (ARCS) model. *Journal of Formative Design in Learning*, *2*(2), 102-113. https://doi.org/10.1007/s41686-018-0021-9

Li, Q., & Baker, R. (2018). The different relationships between engagement and outcomes across participant subgroups in massive open online courses. *Computers & Education*, *127*, 41-65. https://doi.org/10.1016/j.compedu.2018.08.005

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for

reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Journal of clinical epidemiology*, *62*(10), e1-e34. https://doi.org/10.1136/bmj.b2700

Littenberg-Tobias, J., & Reich, J. (2020). Evaluating access, quality, and equity in online learning: A case study of a MOOC-based blended professional degree program. *The Internet and Higher Education*, *47*, 100759. https://doi.org/10.1016/j.iheduc.2020.100759

Littlejohn, A., Hood, N., Milligan, C., & Mustain, P. (2016). Learning in MOOCs: Motivations and self-regulated learning in MOOCs. *The Internet and Higher Education*, *29*, 40-48. https://doi.org/10.1016/j.iheduc.2015.12.003

Liu, Y., Zhang, M., Qi, D., & Zhang, Y. (2022). Understanding the role of learner engagement in determining MOOCs satisfaction: A self-determination theory perspective. *Interactive Learning Environments*, 1-15. https://doi.org/10.1080/10494820.2022.2028853

Liu, Z., Tang, Q., Ouyang, F., Long, T., & Liu, S. (2024). Profiling students' learning engagement in MOOC discussions to identify learning achievement: An automated configurational approach. *Computers & Education*, *219*, 105109. https://doi.org/10.1016/j.compedu.2024.105109

Liu, Z., Zhang, N., Peng, X., Liu, S., Yang, Z., Peng, J., Su, Z., & Chen, J. (2022). Exploring the relationship between social interaction, cognitive processing and learning achievements in a MOOC discussion forum. *Journal of Educational Computing Research*, *60*(1), 132-169. https://doi.org/10.1177/07356331211027300

Loizzo, J., Ertmer, P. A., Watson, W. R., & Watson, S. L. (2017). Adult MOOC learners as self-directed: perceptions of motivation, success, and completion. *Online Learning*, *21*(2), n2. https://doi.org/10.24059/olj.v21i2.889

Loughlin, C., Lygo-Baker, S., & Lindberg-Sand, Å. (2021). Reclaiming constructive alignment. *European Journal of Higher Education*, *11*(2), 119-136. https://doi.org/10.1080/21568235.2020.1816197

Luik, P., Suviste, R., Lepp, M., Palts, T., Tõnisson, E., Säde, M., & Papli, K. (2019). What motivates enrolment in programming MOOCs? *British Journal of Educational Technology*, *50*(1), 153-165. https://doi.org/10.1111/bjet.12600

Luo, Y., Zhou, G., Li, J., & Xiao, X. (2018). Study on MOOC scoring algorithm based on Chinese university MOOC learning behavior data. *Heliyon*, *4*(11), e00960. https://doi.org/10.1016/j.heliyon.2018.e00960

Ma, L., & Lee, C. S. (2019). Understanding the barriers to the use of MOOCs in a developing country: An innovation resistance perspective. *Journal of Educational Computing Research*, *57*(3), 571-590. https://doi.org/10.1177/0735633118757732

Magen-Nagar, N., & Cohen, L. (2017). Learning strategies as a mediator for motivation and a sense of achievement among students who study in MOOCs. *Education and Information Technologies*, *22*(3), 1271-1290. https://doi.org/10.1007/s10639-016-9492-y

Maldonado-Mahauad, J., Pérez-Sanagustín, M., Kizilcec, R. F., Morales, N., & Munoz-Gama, J. (2018). Mining theory-based patterns from Big data: Identifying self-regulated

learning strategies in massive open online courses. *Computers in Human Behavior*, *80*, 179-196. https://doi.org/10.1016/j.chb.2017.11.011

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers & Education*, *80*, 77-83. https://doi.org/10.1016/j.compedu.2014.08.005

Margolis, H., & McCabe, P. P. (2003). Self-efficacy: A key to improving the motivation of struggling learners. *Preventing School Failure: Alternative Education for Children and Youth*, *47*(4), 162-169. https://doi.org/10.1080/10459880309603362

Maya-Jariego, I., Holgado, D., González-Tinoco, E., Castaño-Muñoz, J., & Punie, Y. (2020). Typology of motivation and learning intentions of users in MOOCs: The MOOCKNOWLEDGE study. *Educational Technology Research and Development*, *68*(1), 203-224. https://doi.org/10.1007/s11423-019-09682-3

Meek, S. E., Blakemore, L., & Marks, L. (2017). Is peer review an appropriate form of assessment in a MOOC? Student participation and performance in formative peer review. *Assessment & Evaluation in Higher Education*, *42*(6), 1000-1013. https://doi.org/10.1080/02602938.2016.1221052

Mendoza, N. B., Yan, Z., & King, R. B. (2023). Supporting students' intrinsic motivation for online learning tasks: The effect of need-supportive task instructions on motivation, self-assessment, and task performance. *Computers & Education*, *193*, 104663. https://doi.org/10.1016/j.compedu.2022.104663

Milligan, C., & Littlejohn, A. (2016). How health professionals regulate their learning in massive open online courses. *The Internet and Higher Education*, *31*, 113-121. https://doi.org/10.1016/j.iheduc.2016.07.005

Milligan, C., & Littlejohn, A. (2017). Why study on a MOOC? The motives of students and professionals. *International Review of Research in Open and Distributed Learning*, *18*(2), 92-102. https://doi.org/10.19173/irrodl.v18i2.3033

Min, H., & Nasir, M. (2020). Self-regulated learning in a massive open online course: A review of literature. *European Journal of Interactive Multimedia and Education*, *1*(2), 1-6. https://doi.org/10.30935/ejimed/8403

Min, L., & Foon, H. K. (2019, May 24-27). Self-regulated learning process in MOOCs: Examining the indicators of behavioral, emotional, and cognitive engagement. *Proceedings of the 2019 4th International Conference on Distance Education and Learning*, 99-105. Shanghai, China. https://doi.org/10.1145/3338147.3338161

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS med*, *6*(7), e1000097. https://doi.org/10.1016/j.ijsu.2010.02.007

Najafi, H., Rolheiser, C., Håklev, S., & Harrison, L. (2017). Variations in pedagogical design of massive open online courses (MOOCs) across disciplines. *Teaching & Learning Inquiry*, *5*(2), 47-64. https://doi.org/10.20343/teachlearninqu.5.2.5

Najafi, H., Rolheiser, C., Harrison, L., & Heikoop, W. (2018). Connecting learner motivation to learner progress and completion in massive open online courses. *Canadian Journal of Learning and Technology*, *44*(2). https://doi.org/10.21432/cjlt27559

Narciss, S., Proske, A., & Koerndle, H. (2007). Promoting self-regulated learning in web-based learning environments. *Computers in Human Behavior*, *23*(3), 1126-1144.

https://doi.org/10.1016/j.chb.2006.10.006

Nawrot, I., & Doucet, A. (2014, April 7-11). Building engagement for MOOC students: introducing support for time management on online learning platforms. *Proceedings of the 23rd International Conference on world wide web*, 1077-1082. Seoul, Korea. https://doi.org/10.1145/2567948.2580054

Nunnally, J. C. B. I. H. (1994). *Psychometric theory (3rd edition).* McGraw-Hill.

Nuutila, K., Tuominen, H., Tapola, A., Vainikainen, M.-P., & Niemivirta, M. (2018). Consistency, longitudinal stability, and predictions of elementary school students' task interest, success expectancy, and performance in mathematics. *Learning and instruction*, *56*, 73-83. https://doi.org/10.1016/j.learninstruc.2018.04.003

O'brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & quantity*, *41*(5), 673-690. https://doi.org/10.1007/s11135-006-9018-6

OECD. (2020). The emergence of alternative credentials. https://www.oecd.org/content/dam/oecd/en/publications/reports/2020/03/the-emergence-of-alternative-credentials_48c4ea12/b741f39e-en.pdf

Oh, C., Roumani, Y., Nwankpa, J. K., & Hu, H.-F. (2017). Beyond likes and tweets: Consumer engagement behavior and movie box office in social media. *Information & Management*, *54*(1), 25-37. https://doi.org/10.1016/j.im.2016.03.004

Oh, E. G., Chang, Y., & Park, S. W. (2020). Design review of MOOCs: Application of e-learning design principles. *Journal of computing in higher education*, *32*(3), 455-475. https://doi.org/10.1007/s12528-019-09243-w

Onah, D., & Sinclair, J. (2017). Assessing self-regulation of learning dimensions in a stand-alone MOOC platform. *International Journal of Engineering Pedagogy*, *7*(2), 4-21. https://doi.org/10.3991/ijep.v7i2.6511

Osborne, J. W., & Waters, E. (2002). Four assumptions of multiple regression that researchers should always test. *Practical assessment, research, and evaluation*, *8*(1), 2. https://doi.org/10.7275/r222-hv23

Otto, D., Caeiro, S., Nicolau, P., Disterheft, A., Teixeira, A., Becker, S., Bollmann, A., & Sander, K. (2019). Can MOOCs empower people to critically think about climate change? A learning outcome based comparison of two MOOCs. *Journal of Cleaner Production*, *222*, 12-21. https://doi.org/10.1016/j.jclepro.2019.02.190

Paechter, M., Maier, B., & Macher, D. (2010). Students' expectations of, and experiences in e-learning: Their relation to learning achievements and course satisfaction. *Computers & Education*, *54*(1), 222-229. https://doi.org/10.1016/j.compedu.2009.08.005

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in psychology*, *8*, 422. https://doi.org/10.3389/fpsyg.2017.00422

Papathoma, T., Blake, C., Clow, D., & Scanlon, E. (2015). Investigating learners' views of assessment types in massive open online courses (MOOCs). In Conole, G., Klobučar, T., Rensing, C., Konert, J., Lavoué, E. (Eds), *Design for Teaching and Learning in a Networked World,* 617-621. Springer, Cham. https://doi.org/10.1007/978-3-319-24258-3_72

Pappano, L. (2012, November 2). The Year of the MOOC. *The New York Times*, *2*(12). https://www.nytimes.com/2012/11/04/education/edlife/massive-open-online-courses-are-multiplying-at-a-rapid-pace.html

Part, R., Perera, H. N., Marchand, G. C., & Bernacki, M. L. (2020). Revisiting the dimensionality of subjective task value: Towards clarification of competing perspectives. *Contemporary Educational Psychology*, *62*, 101875. https://doi.org/10.1016/j.cedpsych.2020.101875

Patterson, R. W. (2018). Can behavioral tools improve online student outcomes? Experimental evidence from a massive open online course. *Journal of Economic Behavior and Organization*, *153*, 293-321. https://doi.org/10.1016/j.jebo.2018.06.017

Perez, T., Dai, T., Kaplan, A., Cromley, J. G., Brooks, W. D., White, A. C., Mara, K. R., & Balsai, M. J. (2019). Interrelations among expectancies, task values, and perceived costs in undergraduate biology achievement. *Learning and Individual Differences*, *72*, 26-38. https://doi.org/10.1016/j.lindif.2019.04.001

Pertuz, S., Reyes, O., San Cristobal, E., Meier, R., & Castro, M. (2023). MOOC-based flipped classroom for on-campus teaching in undergraduate engineering courses. *IEEE Transactions on Education*, *66*(5), 468-478. https://doi.org/10.1109/TE.2023.3282896

Pilli, O., & Admiraal, W. (2016). A taxonomy of massive open online courses. *Contemporary Educational Technology*, *7*(3), 223-240. Retrieved from https://www.proquest.com/scholarly-journals/taxonomy-massive-open-online-courses/docview/2135157435/se-2

Pilli, O., & Admiraal, W. (2017). Students' learning outcomes in massive open online courses (MOOCs): Some suggestions for course design. *Journal of Higher Education/Yükseköğretim Dergisi*, *7*(1). https://doi.org/10.2399/yod.17.001

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International journal of educational research*, *31*(6), 459-470. https://doi.org/10.1016/S0883-0355(99)00015-4

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation*, 451-502. Academic Press. https://doi.org/10.1016/B978-012109890-2/50043-3

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of educational psychology*, *82*(1), 33. https://doi.org/10.1037/0022-0663.82.1.33

Pintrich, P. R., Smith, D. A. F., Garcia, T.a., & McKeachie, W. J. (1991). *A manual for the use of the motivated strategies for learning questionnaire (MSLQ)*. Ann Arbor, Michigan: University of Michigan, National Center for Research to Improve Postsecondary Teaching and Learning. Retrieved from https://files.eric.ed.gov/fulltext/ED338122.pdf

Poquet, O., Jovanovic, J., & Dawson, S. (2020). Differences in forum communication of residents and visitors in MOOCS. *Computers & Education*, *156*, 103937. https://doi.org/10.1016/j.compedu.2020.103937

Poquet, O., Kovanović, V., de Vries, P., Hennis, T., Joksimović, S., Gašević, D., Dawson, S., Henderson, S., Conrad, D., & McGreal, R. (2018). Social presence in massive open online courses. *International Review of Research in Open and Distributed Learning*, *19*(3). https://doi.org/10.19173/irrodl.v19i3.3370

Post, L. S., Guo, P., Saab, N., & Admiraal, W. (2019). Effects of remote labs on cognitive, behavioral, and affective learning outcomes in higher education. *Computers & Education*, *140*, 103596. https://doi.org/10.1016/j.compedu.2019.103596

Pozón-López, I., Higueras-Castillo, E., Muñoz-Leiva, F., & Liébana-Cabanillas, F. J. (2021). Perceived user satisfaction and intention to use massive open online courses (MOOCs). *Journal of computing in higher education*, *33*(1), 85-120. https://doi.org/https://doi.org/10.1007/s12528-020-09257-9

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior research methods*, *40*(3), 879-891. https://doi.org/10.3758/BRM.40.3.879

Prior, D. D., Mazanov, J., Meacheam, D., Heaslip, G., & Hanson, J. (2016). Attitude, digital literacy and self efficacy: Flow-on effects for online learning behavior. *The Internet and Higher Education*, *29*, 91-97. https://doi.org/10.1016/j.iheduc.2016.01.001

Qiu, M., & Xu, Y. (2018). Assessing learning outcomes of a MOOC incorporated Into an on-Campus Management Information Systems Class. *Journal of International Technology and Information Management*, *27*(1), 116-128. https://doi.org/10.58729/1941-6679.1368

Rabbany, R., Elatia, S., Takaffoli, M., & Zaïane, O. R. (2013). Collaborative learning of students in online discussion forums: A social network analysis perspective. In Peña-Ayala, A. (Eds.), *Educational data mining: Applications and trends,* 441-466. Springer, Cham. https://doi.org/10.1007/978-3-319-02738-8_16

Rabin, E., Henderikx, M., Yoram, M. K., & Kalz, M. (2020). What are the barriers to learners' satisfaction in MOOCs and what predicts them? The role of age, intention, self-regulation, self-efficacy and motivation. *Australasian Journal of Educational Technology*, *36*(3), 119-131. https://doi.org/10.14742/ajet.5919

Rabin, E., Kalman, Y. M., & Kalz, M. (2019). An empirical investigation of the antecedents of learner-centered outcome measures in MOOCs. *International Journal of Educational Technology in Higher Education*, *16*(1), 1-20. https://doi.org/10.1186/s41239-019-0144-3

Raković, M., Marzouk, Z., Liaqat, A., Winne, P. H., & Nesbit, J. C. (2020). Fine grained analysis of students' online discussion posts. *Computers & Education*, *157*, 103982. https://doi.org/10.1016/j.compedu.2020.103982

Ramesh, A., Goldwasser, D., Huang, B., Daumé III, H., & Getoor, L. (2014, June 26). Understanding MOOC discussion forums using seeded LDA. *Proceedings of the Ninth Workshop on Innovative Use of NLP for Building Educational Applications*, 28-33. Baltimore, United States. Retrieved from https://aclanthology.org/W14-1804.pdf

Ratelle, C. F., Guay, F., Vallerand, R. J., Larose, S., & Senécal, C. (2007). Autonomous, controlled, and amotivated types of academic motivation: A person-oriented analysis. *Journal of educational psychology*, *99*(4), 734-746. https://doi.org/10.1037/0022-0663.99.4.734

Rayyan, S., Fredericks, C., Colvin, K. F., Liu, A., Teodorescu, R., Barrantes, A., Pawl, A., Seaton, D. T., & Pritchard, D. E. (2016). A MOOC based on blended pedagogy. *Journal of Computer Assisted Learning*, *32*(3), 190-201. https://doi.org/10.1111/jcal.12126

Reeve, J., Cheon, S. H., & Yu, T. H. (2020). An autonomy-supportive intervention to develop students' resilience by boosting agentic engagement. *International Journal of Behavioral Development*, *44*(4), 325-338. https://doi.org/10.1177/0165025420911103

Reeve, J., & Tseng, C.-M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology*, *36*(4), 257-267. https://doi.org/10.1016/j.cedpsych.2011.05.002

Reich, J., & Ruipérez-Valiente, J. A. (2019). The MOOC pivot. *Science*, *363*(6423), 130-131. https://doi.org/10.1126/science.aav7958

Rivera, D. A., Frenay, M., & Swaen, V. (2024). The learning design of MOOC discussion forums: An analysis of forum instructions and their role in supporting the social construction of knowledge. *Technology, Knowledge and Learning*, *29*(2), 585-615. https://doi.org/10.1007/s10758-023-09670-w

Rizvi, S., Rienties, B., Rogaten, J., & Kizilcec, R. F. (2019). Investigating Variation in Learning Processes in a FutureLearn MOOC. *Journal of computing in higher education*, *32*(1), 162-181. https://doi.org/10.1007/s12528-019-09231-0

Rodriguez, B. P., & Armellini, A. (2017). Developing self-efficacy through a massive open online course on study skills. *Open Praxis*, *9*(3), 335-343. https://doi.org/10.5944/openpraxis.9.3.659

Rose, C. E., Martin, S. W., Wannemuehler, K. A., & Plikaytis, B. D. (2006). On the use of zero-inflated and hurdle models for modeling vaccine adverse event count data. *Journal of biopharmaceutical statistics*, *16*(4), 463-481. https://doi.org/10.1080/10543400600719384

Rosé, C. P., Carlson, R., Yang, D., Wen, M., Resnick, L., Goldman, P., & Sherer, J. (2014, March 4-5). Social factors that contribute to attrition in MOOCs. *Proceedings of the first ACM conference on Learning @ scale conference*, 197-198. Atlanta, United States. https://doi.org/10.1145/2556325.2567879

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of personality*, *63*(3), 397-427. https://doi.org/10.1111/j.1467-6494.1995.tb00501.x

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: examining reasons for acting in two domains. *Journal of personality and social psychology*, *57*(5), 749-761. https://psycnet.apa.org/doi/10.1037/0022-3514.57.5.749

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, *25*(1), 54-67. https://doi.org/10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, *55*(1), 68-78. https://doi.org/10.1037110003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2002). Overview of self-determination theory: An organismic dialectical perspective. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research*, *2*, 3-33. University of Rochester Press, New York. Retrieved from https://www.elaborer.org/cours/A16/lectures/Ryan2004.pdf

Sa'don, N. F., Alias, R. A., & Ohshima, N. (2014, November 25-27). Nascent research trends in MOOCs in higher educational institutions: A systematic literature review. *Proceedings of the 2014 International Conference on Web and Open Access to Learning (ICWOAL)*, 1-4. Dubai, United Arab Emirates. https://doi.org/10.1109/ICWOAL.2014.7009215.

Sandeen, C. (2013). Assessment's place in the new MOOC world. *Research & practice in assessment*, *8*, 5-12. Retrieved from https://files.eric.ed.gov/fulltext/EJ1062706.pdf

Santosa, P. I. (2015). Student engagement with online tutorial: A Perspective on Flow Theory. *International Journal of Emerging Technologies in Learning*, *10*(1), 60-67. http://dx.doi.org/10.3991/ijet.v10i1.4348

Sanz-Martínez, L., Er, E., Martínez-Monés, A., Dimitriadis, Y., & Bote-Lorenzo, M. L. (2019). Creating collaborative groups in a MOOC: a homogeneous engagement grouping approach. *Behaviour & Information Technology*, *38*(11), 1107-1121. https://doi.org/10.1080/0144929X.2019.1571109

Schrire, S. (2006). Knowledge building in asynchronous discussion groups: Going beyond quantitative analysis. *Computers & Education*, *46*(1), 49-70. https://doi.org/10.1016/j.compedu.2005.04.006

Schultz, B. B. (1985). Levene's test for relative variation. *Systematic Zoology*, *34*(4), 449-456. https://doi.org/10.1093/sysbio/34.4.449

Semenova, T. (2022). The role of learners' motivation in MOOC completion. *Open Learning: The Journal of Open, Distance and e-Learning*, *37*(3), 273-287. https://doi.org/10.1080/02680513.2020.1766434

Shapiro, H. B., Lee, C. H., Roth, N. E. W., Li, K., Çetinkaya-Rundel, M., & Canelas, D. A. (2017). Understanding the massive open online course (MOOC) student experience: An examination of attitudes, motivations, and barriers. *Computers & Education*, *110*, 35-50. https://doi.org/10.1016/j.compedu.2017.03.003

Shavelson, R. J., & Huang, L. (2003). Responding responsibly. *Change: The magazine of higher learning*, *35*(1), 10-19. https://doi.org/10.1080/00091380309604739

Shuell, T. J. (1986). Cognitive conceptions of learning. *Review of educational research*, *56*(4), 411-436. https://doi.org/10.3102/00346543056004411

Sicilia, Á., Sáenz-Alvarez, P., González-Cutre, D., & Ferriz, R. (2015). Analysing the influence of autonomous and controlling social factors within the theory of planned behaviour. *Australian Psychologist*, *50*(1), 70-79. https://doi.org/10.1111/ap.12077

Simonson, M. R. (1979). Designing instruction for attitudinal outcomes. *Journal of instructional development*, *2*(3), 15-19. https://doi.org/10.1007/BF02984375

Singh, A. B., & Mørch, A. I. (2018). An analysis of participants' experiences from the first international MOOC offered at the University of Oslo. *13*(01), 40-64. https://doi.org/10.18261/issn.1891-943x-2018-01-04

Skinner, E., Furrer, C., Marchand, G., & Kindermann, T. (2008). Engagement and disaffection in the classroom: Part of a larger motivational dynamic? *Journal of educational psychology*, *100*(4), 765-781. https://psycnet.apa.org/doi/10.1037/a0012840

Stamov Roßnagel, C., Fitzallen, N., & Lo Baido, K. (2021). Constructive alignment and the learning experience: relationships with student motivation and perceived learning demands. *Higher education research & development*, *40*(4), 838-851. https://doi.org/10.1080/07294360.2020.1787956

Stephens-Martinez, K., Hearst, M. A., & Fox, A. (2014, March 4-5). Monitoring moocs: which information sources do instructors value? *Proceedings of the first ACM conference on Learning @ scale conference*, 79-88. Atlanta, United States. https://doi.org/10.1145/2556325.2566246

Stich, A. E., & Reeves, T. D. (2017). Massive open online courses and underserved students in the United States. *The Internet and Higher Education*, *32*, 58-71. https://doi.org/10.1016/j.iheduc.2016.09.001

Strijbos, J. W., Martens, R. L., Prins, F. J., & Jochems, W. M. (2006). Content analysis: What are they talking about? *Computers & Education*, *46*(1), 29-48. https://doi.org/10.1016/j.compedu.2005.04.002

Stroet, K., Opdenakker, M. C., & Minnaert, A. (2013). Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. *Educational Research Review*, *9*, 65-87. https://doi.org/10.1016/j.edurev.2012.11.003

Sun, G., & Bin, S. (2018). Topic interaction model based on local community detection in MOOC discussion forums and its teaching application. *Kuram ve Uygulamada Egitim Bilimleri*, *18*(6), 2922-2931. https://doi.org/10.12738/estp.2018.6.191

Sun, J. C. Y., & Rueda, R. (2012). Situational interest, computer self-efficacy and self-regulation: Their impact on student engagement in distance education. *British Journal of Educational Technology*, *43*(2), 191-204. https://doi.org/10.1111/j.1467-8535.2010.01157.x

Sun, Y., Ni, L., Zhao, Y., Shen, X. L., & Wang, N. (2019). Understanding students' engagement in MOOCs: An integration of self-determination theory and theory of relationship quality. *British Journal of Educational Technology*, *50*(6), 3156-3174. https://doi.org/10.1111/bjet.12724

Sunar, A. S., Abbasi, R. A., Davis, H. C., White, S., & Aljohani, N. R. (2018). Modelling MOOC learners' social behaviours. *Computers in Human Behavior*, *107*, 105835. https://doi.org/10.1016/j.chb.2018.12.013

Sunar, A. S., White, S., Abdullah, N. A., & Davis, H. C. (2016). How learners' interactions sustain engagement: A MOOC case study. *IEEE Transactions on Learning Technologies*, *10*(4), 475-487. https://doi.org/10.1109/TLT.2016.2633268

Swinnerton, B. J., Morris, N. P., Hotchkiss, S., & Pickering, J. D. (2017). The integration of an anatomy massive open online course (MOOC) into a medical anatomy curriculum. *Anatomical sciences education*, *10*(1), 53-67. https://doi.org/10.1002/ase.1625

Tang, C. M., & Chaw, L. (2019). Driving high inclination to complete massive open online courses (MOOCs): Motivation and engagement factors for learners. *Electronic Journal of E-learning*, *17*, 118-130. http://dx.doi.org/10.34190/JEL.17.2.05

Tang, H., Xing, W., & Pei, B. (2018). Exploring the temporal dimension of forum participation in MOOCs. *Distance Education*, *39*(3), 353-372. https://doi.org/10.1080/01587919.2018.1476841

Taskin, Y., Hecking, T., Hoppe, H. U., Dimitrova, V., & Mitrovic, A. (2019). Characterizing comment types and levels of engagement in video-based learning as a basis for adaptive nudging. In Scheffel, M., Broisin, J., Pammer-Schindler, V., Ioannou, A., Schneider, J. (Eds.), *Transforming Learning with Meaningful Technologies*, 362-376. Springer, Cham. https://doi.org/10.1007/978-3-030-29736-7_27

Tawfik, A. A., Reeves, T. D., Stich, A. E., Gill, A., Hong, C., McDade, J., Pillutla, V. S., Zhou, X., & Giabbanelli, P. J. (2017). The nature and level of learner-learner interaction in a chemistry massive open online course (MOOC). *Journal of computing in higher education*, *29*, 411-431. https://doi.org/10.1007/s12528-017-9135-3

Theil, H., & Nagar, A. (1961). Testing the independence of regression disturbances. *Journal of the American Statistical Association*, *56*(296), 793-806. https://doi.org/10.1080/01621459.1961.10482126

Tobias, S., & Carlson, J. E. (1969). Brief report: Bartlett's test of sphericity and chance findings in factor analysis. *Multivariate behavioral research*, *4*(3), 375-377. https://doi.org/10.1207/s15327906mbr0403_8

Torres, W. J., & Beier, M. E. (2018). Adult development in the wild: The determinants of autonomous learning in a massive open online course. *Learning and Individual Differences*, *65*, 207-217. https://doi.org/10.1016/j.lindif.2018.06.003

Tseng, H., Kuo, Y.-C., & Walsh, E. J. (2020). Exploring first-time online undergraduate and graduate students' growth mindsets and flexible thinking and their relations to online learning engagement. *Educational Technology Research and Development*, *68*(5), 2285-2303. https://doi.org/10.1007/s11423-020-09774-5

Tseng, S. F., Tsao, Y. W., Yu, L. C., Chan, C. L., & Lai, K. R. (2016). Who will pass? Analyzing learner behaviors in MOOCs. *Research and Practice in Technology Enhanced Learning*, *11*(1), 1-11. https://doi.org/10.1186/s41039-016-0033-5

Turk, M., Heddy, B. C., & Danielson, R. W. (2022). Teaching and social presences supporting basic needs satisfaction in online learning environments: How can presences and basic needs happily meet online? *Computers & Education*, *180*, 104432. https://doi.org/10.1016/j.compedu.2022.104432

UNESCO. (2016). Education 2030: Incheon declaration and framework for action: Towards inclusive and equitable quality education and lifelong learning for all. https://unesdoc.unesco.org/ark:/48223/pf0000245656/Pdf/245656eng.pdf.multi

UNESCO & Commonwealth of Learning. (2016). Making sense of MOOCs: A guide for policy-makers in developing countries. https://doi.org/10.54675/CKLG5881

Valdivia Vázquez, J. A., Ramírez-Montoya, M. S., Valenzuela González, J. R., Henderson, S., Conrad, D., McGreal, R., & Kennepohl, D. (2018). Motivation and knowledge: Pre-assessment and post-assessment of MOOC participants from an Energy and Sustainability Project. *International Review of Research in Open and Distributed Learning*, *19*(4), 116-132. https://doi.org/10.19173/irrodl.v19i4.3489

van de Oudeweetering, K., & Agirdag, O. (2018). Demographic data of MOOC learners: Can alternative survey deliveries improve current understandings? *Computers & Education*, *122*, 169-178. https://doi.org/10.1016/j.compedu.2018.03.017

van den Beemt, A., Buijs, J., van der Aalst, W., Henderson, S., Conrad, D., McGreal, R., & Kennepohl, D. (2018). Analysing structured learning behaviour in massive ppen online courses (MOOCs): An approach based on process mining and clustering. *International Review of Research in Open and Distributed Learning*, *19*(5). https://doi.org/10.19173/irrodl.v19i5.3748

Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of educational psychology*, *101*(3), 671-688. https://psycnet.apa.org/doi/10.1037/a0015083

Vayre, E., & Vonthron, A. M. (2017). Psychological engagement of students in distance and online learning: Effects of self-efficacy and psychosocial processes. *Journal of Educational Computing Research*, *55*(2), 197-218. https://doi.org/10.1177/0735633116656849

Vayre, E., & Vonthron, A. M. (2019). Relational and psychological factors affecting exam participation and student achievement in online college courses. *The Internet and Higher Education*, *43*, 100671. https://doi.org/10.1016/j.iheduc.2018.07.001

Vellukunnel, M., Buffum, P., Boyer, K. E., Forbes, J., Heckman, S., & Mayer-Patel, K. (2017, March 8-11). Deconstructing the discussion forum: Student questions and computer science learning. *Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education*, 603-608. Seattle, United States. https://doi.org/10.1145/3017680.3017745

Vera, M. d. M. S., Calatayud, V. G., & Espinosa, M. P. P. (2017). Los MOOC y la evaluación del alumnado: revisión sistemática (2012-2016). *@ tic. revista d'innovació educativa*(18), 65. https://doi.org/10.7203/ATTIC.18.10013

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard Uuniversity Press.

Walker, C. O., Greene, B. A., & Mansell, R. A. (2006). Identification with academics, intrinsic/extrinsic motivation, and self-efficacy as predictors of cognitive engagement. *Learning and individual differences*, *16*(1), 1-12. https://doi.org/10.1016/j.lindif.2005.06.004

Wang, C. H., Shannon, D. M., & Ross, M. E. (2013). Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. *Distance Education*, *34*(3), 302-323. https://doi.org/10.1080/01587919.2013.835779

Wang, L., Hu, G., & Zhou, T. (2018). Semantic analysis of learners' emotional tendencies on online MOOC education. *Sustainability*, *10*(6), 1921. https://doi.org/10.3390/su10061921

Wang, W., Guo, L., He, L., & Wu, Y. J. (2019). Effects of social-interactive engagement on the dropout ratio in online learning: insights from MOOC. *Behaviour & Information Technology*, *38*(6), 621-636. https://doi.org/10.1080/0144929X.2018.1549595

Wang, X., Su, Y., Cheung, S., Wong, E., & Kwong, T. (2013). An exploration of Biggs' constructive alignment in course design and its impact on students' learning approaches. *Assessment & Evaluation in Higher Education*, *38*(4), 477-491. https://doi.org/10.1080/02602938.2012.658018

Wang, X., Wen, M., & Rosé, C. P. (2016, April 25-29). Towards triggering higher-order thinking behaviors in MOOCs. *Proceedings of the Sixth International Conference on Learning Analytics & Knowledg*, 398-407. Edinburgh, United Kingdom. https://doi.org/10.1145/2883851.2883964

Wang, X., Yang, D., Wen, M., Koedinger, K., & Rosé, C. P. (2015, June 26-29). Investigating how student's cognitive behavior in MOOC discussion forums affect learning gains. *Proceedings of the 8th International Conference on Educational Data Mining*, 226-233. Madrid, Spain. Retrieved from https://files.eric.ed.gov/fulltext/ED560568.pdf

Wang, Z., Anderson, T., Chen, L., Henderson, S., Conrad, D., & McGreal, R. (2018). How learners participate in connectivist learning: An analysis of the interaction traces from a

cMOOC. *International Review of Research in Open and Distributed Learning*, *19*(1). https://doi.org/10.19173/irrodl.v19i1.3269

Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge University Press.

Watson, S. L., Watson, W. R., Yu, J. H., Alamri, H., & Mueller, C. (2017). Learner profiles of attitudinal learning in a MOOC: An explanatory sequential mixed methods study. *Computers & Education*, *114*, 274-285. https://doi.org/10.1016/j.compedu.2017.07.005

Watted, A., & Barak, M. (2018). Motivating factors of MOOC completers: Comparing between university-affiliated students and general participants. *The Internet and Higher Education*, *37*, 11-20. https://doi.org/10.1016/j.iheduc.2017.12.001

Wei, W., Liu, J., Xu, X., Kolletar-Zhu, K., & Zhang, Y. (2023). Effective interactive engagement strategies for MOOC forum discussion: A self-efficacy perspective. *Plos one*, *18*(11), e0293668. https://doi.org/10.1371/journal.pone.0293668

Wei, X., Saab, N., & Admiraal, W. (2021). Assessment of cognitive, behavioral, and affective learning outcomes in massive open online courses: A systematic literature review. *Computers & Education*, *163*, 104097. https://doi.org/10.1016/j.compedu.2020.104097

Wei, X., Saab, N., & Admiraal, W. (2023). Do learners share the same perceived learning outcomes in MOOCs? Identifying the role of motivation, perceived learning support, learning engagement, and self-regulated learning strategies. *The Internet and Higher Education*, *56*, 100880. https://doi.org/10.1016/j.iheduc.2022.100880

Wei, X., Saab, N., & Admiraal, W. (2024). What rationale would work? Unfolding the role of learners' attitudes and motivation in predicting learning engagement and perceived learning outcomes in MOOCs. *International Journal of Educational Technology in Higher Education*, *21*(1), 5. https://doi.org/10.1186/s41239-023-00433-2

Wekerle, C., Daumiller, M., Janke, S., Dickhäuser, O., Dresel, M., & Kollar, I. (2024). Putting ICAP to the test: how technology-enhanced learning activities are related to cognitive and affective-motivational learning outcomes in higher education. *Scientific Reports*, *14*(1), 16295. https://doi.org/10.1038/s41598-024-66069-y

Wigfield, A., & Cambria, J. (2010). Students' achievement values, goal orientations, and interest: Definitions, development, and relations to achievement outcomes. *Developmental review*, *30*(1), 1-35. https://doi.org/10.1016/j.dr.2009.12.001

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, *25*(1), 68-81. https://doi.org/10.1006/ceps.1999.1015

Williams, K. M., Stafford, R. E., Corliss, S. B., & Reilly, E. D. (2018). Examining student characteristics, goals, and engagement in massive open online courses. *Computers & Education*, *126*, 433-442. https://doi.org/10.1016/j.compedu.2018.08.014

Williams, R. T. (2024). An overview of MOOCs and blended learning: integrating MOOC technologies into traditional classes. *IETE Journal of Education*, *65*(2), 84-91. https://doi.org/10.1080/09747338.2024.2303040

Wise, A. F., & Cui, Y. (2018, March 7-9). Unpacking the relationship between discussion forum participation and learning in MOOCs: Content is key. *Proceedings of the 8th International Conference on Learning Analytics and Knowledge*, 330-339. Sydney, Australia. https://doi.org/10.1145/3170358.3170403

Wong, J., Baars, M., Davis, D., Van Der Zee, T., Houben, G. J., & Paas, F. (2019). Supporting self-regulated learning in online learning environments and MOOCs: A systematic review. *International Journal of Human–Computer Interaction*, *35*(4-5), 356-373. https://doi.org/10.1080/10447318.2018.1543084

Wong, J., Khalil, M., Baars, M., de Koning, B. B., & Paas, F. (2019). Exploring sequences of learner activities in relation to self-regulated learning in a massive open online course. *Computers & Education*, *140*, 103595. https://doi.org/10.1016/j.compedu.2019.103595

Woo, Y., & Reeves, T. C. (2007). Meaningful interaction in web-based learning: A social constructivist interpretation. *The Internet and Higher Education*, *10*(1), 15-25. https://doi.org/10.1016/j.iheduc.2006.10.005

Wu, B., & Chen, X. (2017). Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model. *Computers in Human Behavior*, *67*, 221-232. https://doi.org/10.1016/j.chb.2016.10.028

Wu, W. H., Kao, H. Y., Wu, S. H., & Wei, C. W. (2019). Development and evaluation of affective domain using Student's feedback in entrepreneurial MOOC courses. *Frontiers in psychology*, *10*, 1109. https://doi.org/10.3389/fpsyg.2019.01109

Xing, W. (2019). Exploring the influences of MOOC design features on student performance and persistence. *Distance Education*, *40*(1), 98-113. https://doi.org/10.1080/01587919.2018.1553560

Xiong, Y., & Suen, H. K. (2018). Assessment approaches in massive open online courses: Possibilities, challenges and future directions. *International Review of Education*, *64*(2), 241-263. https://doi.org/10.1007/s11159-018-9710-5

Yang, D., Sinha, T., Adamson, D., & Rosé, C. P. (2013, December). Turn on, tune in, drop out: Anticipating student dropouts in massive open online courses. *Proceedings of the 2013 NIPS Data-driven education workshop*, *11*, 14. Lake Tahoe, Nevada, United States. Retrieved from https://www-cs.stanford.edu/~diyiy/docs/nips13.pdf

Yang, H. H., & Su, C. H. (2017). Learner behaviour in a MOOC practice-oriented course: in empirical study integrating TAM and TPB. *The International Review of Research in Open and Distributed Learning*, *18*(5), 35-63. https://doi.org/10.19173/irrodl.v18i5.2991

Yang, Q. (2014). Students motivation in asynchronous online discussions with MOOC mode. *American Journal of Educational Research*, *2*(5), 325-330. https://doi.org/10.12691/education-2-5-1

Yau, K. K., Wang, K., & Lee, A. H. (2003). Zero-inflated negative binomial mixed regression modeling of over-dispersed count data with extra zeros. *Biometrical Journal: journal of mathematical methods in biosciences*, *45*(4), 437-452. https://doi.org/10.1002/bimj.200390024

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2014, July 7-10). What drives a successful MOOC? An empirical examination of criteria to assure design quality of MOOCs. *2014 IEEE 14th International Conference on Advanced Learning Technologies*, 44-48. Athens, Greece. https://doi.org/10.1109/ICALT.2014.23.

Yu, A. Y., Tian, S. W., Vogel, D., & Kwok, R. C.-W. (2010). Can learning be virtually boosted? An investigation of online social networking impacts. *Computers & Education*, *55*(4), 1494-1503. https://doi.org/10.1016/j.compedu.2010.06.015

Yuan, L., Powell, S., & Olivier, B. (2014). Beyond MOOCs: Sustainable online learning in institutions. https://publications.cetis.org.uk/wp-content/uploads/2014/01/Beyond-MOOCs-Sustainable-Online-Learning-in-Institutions.pdf

Yurdabakan, I. (2016). The investigation of the prospective teachers' opinions related to peer assessment: A qualitative study. *Online Submission*, *7*(4), 1-12. Retrieved from https://files.eric.ed.gov/fulltext/ED581695.pdf

Zainab, B., Awais Bhatti, M., & Alshagawi, M. (2017). Factors affecting e-training adoption: An examination of perceived cost, computer self-efficacy and the technology acceptance model. *Behaviour & Information Technology*, *36*(12), 1261-1273. https://doi.org/10.1080/0144929X.2017.1380703

Zhang, S., & Liu, Q. (2019). Investigating the relationships among teachers' motivational beliefs, motivational regulation, and their learning engagement in online professional learning communities. *Computers & Education*, *134*, 145-155. https://doi.org/10.1016/j.compedu.2019.02.013

Zheng, S., Rosson, M. B., Shih, P. C., & Carroll, J. M. (2015, March 14-18). Understanding student motivation, behaviors and perceptions in MOOCs. *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*, 1882-1895. Vancouver, Canada. https://doi.org/10.1145/2675133.2675217

Zhou, M. (2016). Chinese university students' acceptance of MOOCs: A self-determination perspective. *Computers & Education*, *92*, 194-203. https://doi.org/10.1016/j.compedu.2015.10.012

Zhu, M., Sari, A., & Lee, M. M. (2018). A systematic review of research methods and topics of the empirical MOOC literature (2014-2016). *The Internet and Higher Education*, *37*, 31-39. https://doi.org/10.1016/j.iheduc.2018.01.002

Zielinski, M., West, V., Merzdorf, H. E., Douglas, K. A., & Bermel, P. (2019). Motivation and perceived costs to achievement in advanced moocs: a mixed method study of advanced engineering mooc engineering learners' motivation and perceived barriers. *The International journal of engineering education*, *35*(5), 1540-1550. Retrieved from https://www.ijee.ie/1atestissues/Vol35-5/26_ijee3818.pdf

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, *25*(1), 82-91. https://doi.org/10.1006/ceps.1999.1016

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into practice*, *41*(2), 64-70. https://doi.org/10.1207/s15430421tip4102_2

Zuur, A. F., Saveliev, A. A., & Ieno, E. N. (2012). *Zero inflated models and generalized linear mixed models with R*. Highland Statistics Limited.

Appendices

Appendix A. References of studies included in the systematic literature review

*Almeda, M. V., Zuech, J., Baker, R. S., Utz, C., Higgins, G., & Reynolds, R. (2018). Comparing the factors that predict completion and grades among for-credit and open/MOOC students in online learning. *Online Learning*, *22*(1), 1-18. Retrieved from: https://www.learntechlib.org/p/189536/.

*Balint, T. A., Teodorescu, R., Colvin, K., Choi, Y. J., & Pritchard, D. (2017). Physics instructional resource usage by high-, medium-, and low-skilled MOOC students. *The Physics Teacher*, *55*(4), 222-225. https://doi.org/10.1119/1.4978719

*Bonafini, F. C. (2017). The effects of participants' engagement with videos and forums in a MOOC for teachers' professional development. *Open Praxis*, *9*(4), 433-447. https://doi.org/10.5944/openpraxis.9.4.637

*Bonafini, F. C., Chae, C., Park, E., & Jablokow, K. (2017). How much does student engagement with videos and forums in a MOOC affect their achievement? *Online Learning Journal*, *21*(4), 223-240. Retrieved from https://www.learntechlib.org/p/183772/.

*Buhr, E. E., Daniels, L. M., & Goegan, L. D. (2019). Cognitive appraisals mediate relationships between two basic psychological needs and emotions in a massive open online course. *Computers in Human Behavior*, *96*, 85-94. https://doi.org/10.1016/j.chb.2019.02.009

*Chang, J. J., Lin, W. S., & Chen, H. R. (2019). How attention level and cognitive style affect learning in a MOOC environment? Based on the perspective of brainwave analysis. *Computers in Human Behavior, 100*, 209-217. https://doi.org/10.1016/j.chb.2018.08.016

*Chiu, T. K. F., & Hew, T. K. F. (2018). Factors influencing peer learning and performance in MOOC asynchronous online discussion forum. *Australasian Journal of Educational Technology, 34*(4), 16. https://doi.org/10.14742/ajet.3240

*Comer, D. (2017). Learning transfer, feedback, and massive open online courses. *Journal of Systemics, Cybernetics and Informatics*, *15*(1), 44-52. Retrieved from: http://www.iiisci.org/Journal/CV$/sci/pdfs/SA611XH16.pdf

*Conijn, R., Van Den Beemt, A., & Cuijpers, P. (2018). Predicting student performance in a blended MOOC. *Journal of Computer Assisted Learning, 34*(5), 615-628. https://doi.org/10.1111/jcal.12270

*DeBoer, J., Haney, C., Atiq, S. Z., Smith, C., & Cox, D. (2019). Hands-on engagement online: Using a randomised control trial to estimate the impact of an at-home lab kit on student attitudes and achievement in a MOOC. *European Journal of Engineering Education, 44*(1-2), 234-252. https://doi.org/10.1080/03043797.2017.1378170

*de Lima, M., & Zorrilla, M. E. (2017). Social networks and the building of learning communities: An experimental study of a social MOOC. *International Review of Research in Open and Distributed Learning, 18*(1), 40-64. https://doi.org/10.19173/irrodl.v18i1.2630

A

*Duan, J., Xie, K., Hawk, N. A., Yu, S., & Wang, M. (2019). Exploring a personal social knowledge network (PSKN) to aid the observation of connectivist interaction for high- and low-performing learners in connectivist massive open online courses. *British Journal of Educational Technology*, *50*(1), 199-217. https://doi.org/10.1111/bjet.12687

*Eccleston, C., Doherty, K., Bindoff, A., Robinson, A., Vickers, J., & McInerney, F. (2019). Building dementia knowledge globally through the understanding dementia Massive Open Online Course (MOOC). *npj Science of Learning*, *4*(1), 1-6. https://doi.org/10.1038/s41539-019-0042-4

*Emanuel, J. P., & Lamb, A. (2017). Open, online, and blended: Transactional interactions with MOOC content by learners in three different course formats. *Online Learning*, *21*(2). https://dx.doi.org/10.2139/ssrn.2666657

*Formanek, M., Wenger, M. C., Buxner, S. R., Impey, C. D., & Sonam, T. (2017). Insights about large-scale online peer assessment from an analysis of an astronomy MOOC. *Computers & Education, 113*, 243-262. https://doi.org/10.1016/j.compedu.2017.05.019

*Harvey, L. A., Glinsky, J. V., Muldoon, S., & Chhabra, H. S. (2017). Massive open online courses for educating physiotherapists about spinal cord injuries: a descriptive study. *Spinal Cord Series and Cases*, *3*, 17005. https://doi.org/10.1038/scsandc.2017.5

*Hudson, L., Wolff, A., Gooch, D., Van Der Linden, J., Kortuem, G. W., Petre, M., & O'Connor-Gotra, S. (2019). Supporting urban change: Using a MOOC to facilitate attitudinal learning and participation in smart cities. *Computers & Education, 129*, 37-47. https://doi.org/10.1016/j.compedu.2018.10.012

*Jia, M., Gong, D., Luo, J., Zhao, J., Zheng, J., & Li, K. (2019). Who can benefit more from massive open online courses? A prospective cohort study. *Nurse education today, 76*, 96-102. https://doi.org/10.1016/j.nedt.2019.02.004

*Jung, E., Kim, D., Yoon, M., Park, S., & Oakley, B. (2019). The influence of instructional design on learner control, sense of achievement, and perceived effectiveness in a supersize MOOC course. *Computers & Education, 128*, 377-388. https://doi.org/10.1016/j.compedu.2018.10.001

*Jung, Y., & Lee, J. (2018). Learning engagement and persistence in massive open online courses (MOOCs). *Computers & Education, 122*, 9-22. https://doi.org/10.1016/j.compedu.2018.02.013

*Kahan, T., Soffer, T., & Nachmias, R. (2017). Types of participant behavior in a massive open online course. *The International Review of Research in Open and Distributed Learning, 18*(6), 1-18. https://doi.org/10.19173/irrodl.v18i6.3087

*Khalil, M., & Ebner, M. (2017). Clustering patterns of engagement in massive open online courses (MOOCs): The use of learning analytics to reveal student categories. *Journal of Computing in Higher Education, 29*(1), 114-132. https://doi.org/10.1007/s12528-016-9126-9

*Kizilcec, R. F., Pérez-Sanagustín, M., & Maldonado, J. J. (2017). Self-regulated learning strategies predict learner behavior and goal attainment in massive open online courses. *Computers & Education, 104*, 18-33. https://doi.org/10.1016/j.compedu.2016.10.001

*Kormos, J., & Nijakowska, J. (2017). Inclusive practices in teaching students with dyslexia: Second language teachers' concerns, attitudes and self-efficacy beliefs on a massive open online learning course. *Teaching and Teacher Education, 68*, 30-41.

https://doi.org/10.1016/j.tate.2017.08.005

*Kovanović, V., Joksimović, S., Poquet, O., Hennis, T., de Vries, P., Hatala, M., & Gašević, D. (2019). Examining communities of inquiry in massive open online courses: The role of study strategies. *The Internet and Higher Education, 40*, 20-43. https://doi.org/10.1016/j.iheduc.2018.09.001

*Krasny, M. E., DuBois, B., Adameit, M., Atiogbe, R., Alfakihuddin, M. L. B., Bold-erdene, T., & Leung, Y. (2018). Small groups in a social learning MOOC (sIMOOC): Strategies for fostering learning and knowledge creation. *Online Learning, 22*(2), 119-139. Retrieved from: https://files.eric.ed.gov/fulltext/EJ1181445.pdf

*Lan, M., Hou, X., Qi, X., & Mattheos, N. (2019). Self-regulated learning strategies in world's first MOOC in implant dentistry. *European Journal of Dental Education*, *23*(3), 278-285. https://doi.org/10.1111/eje.12428

*Lee, Y. (2018). Effect of uninterrupted time-on-task on students' success in massive open online courses (MOOCs). *Computers in Human Behavior, 86*, 174-180. https://doi.org/10.1016/j.chb.2018.04.043

*Lee, Y. (2019). Using self-organizing map and clustering to investigate problem-solving patterns in the massive open online course: An exploratory study. *Journal of Educational Computing Research, 57*(2), 471-490. https://doi.org/10.1177/0735633117753364

*Li, B., Wang, X., & Tan, S. C. (2018). What makes MOOC users persist in completing MOOCs? A perspective from network externalities and human factors. *Computers in Human Behavior, 85*, 385-395. https://doi.org/10.1016/j.chb.2018.04.028

*Li, K. (2019). MOOC learners' demographics, self-regulated learning strategy, perceived learning and satisfaction: A structural equation modeling approach. *Computers & Education, 132*, 16-30. https://doi.org/10.1016/j.compedu.2019.01.003

*Li, K., & Moore, D. R. (2018). Motivating students in massive open online courses (MOOCs) using the attention, relevance, confidence, satisfaction (ARCS) model. *Journal of Formative Design in Learning, 2*(2), 102-113. https://doi.org/10.1007/s41686-018-0021-9

*Li, Q., & Baker, R. (2018). The different relationships between engagement and outcomes across participant subgroups in massive open online courses. *Computers & Education, 127*, 41-65. https://doi.org/10.1016/j.compedu.2018.08.005

*Loizzo, J., Ertmer, P. A., Watson, W. R., & Watson, S. L. (2017). Adult MOOC learners as self-directed: Perceptions of motivation, success, and completion. *Online Learning, 21*(2). http://dx.doi.org/10.24059/olj.v21i2.889

*Luo, Y., Zhou, G., Li, J., & Xiao, X. (2018). Study on MOOC scoring algorithm based on Chinese University MOOC learning behavior data. *Heliyon, 4*(11), e00960. https://doi.org/10.1016/j.heliyon.2018.e00960

*Maldonado-Mahauad, J., Pérez-Sanagustín, M., Kizilcec, R. F., Morales, N., & Munoz-Gama, J. (2018). Mining theory-based patterns from big data: Identifying self-regulated learning strategies in massive open online courses. *Computers in Human Behavior, 80*, 179-196. https://doi.org/10.1016/j.chb.2017.11.011

*Meek, S. E., Blakemore, L., & Marks, L. (2017). Is peer review an appropriate form of assessment in a MOOC? Student participation and performance in formative peer review. *Assessment & Evaluation in Higher Education, 42*(6), 1000-1013. https://doi.org/10.1080/02602938.2016.1221052

*Moreno-Marcos, P. M., Muñoz-Merino, P. J., Alario-Hoyos, C., Estévez-Ayres, I., & Delgado Kloos, C. (2018). Analysing the predictive power for anticipating assignment grades in a massive open online course. *Behaviour & Information Technology*, *37*(10-11), 1021-1036. https://doi.org/10.1080/0144929X.2018.1458904

*Najafi, H., Rolheiser, C., Håklev, S., & Harrison, L. (2017). Variations in pedagogical design of massive open online courses (MOOCs) across disciplines. *Teaching & Learning Inquiry, 5*(2), 47-64. https://doi.org/10.20343/teachlearninqu.5.2.5

*Najafi, H., Rolheiser, C., Harrison, L., & Heikoop, W. (2018). Connecting learner motivation to learner progress and completion in massive open online courses. *Canadian Journal of Learning and Technology, 44*(2). https://doi.org/10.21432/cjlt27559

*Onah, D., & Sinclair, J. (2017). Assessing self-regulation of learning dimensions in a stand-alone MOOC platform. *International Journal of Engineering Pedagogy, 7*(2), 4-21. https://www.learntechlib.org/p/207403/.

*Patterson, R. W. (2018). Can behavioral tools improve online student outcomes? Experimental evidence from a massive open online course. *Journal of Economic Behavior & Organization, 153*, 293-321. https://doi.org/10.1016/j.jebo.2018.06.017

*Poquet, O., Kovanović, V., de Vries, P., Hennis, T., Joksimović, S., Gašević, D., & Dawson, S. (2018). Social presence in massive open online courses. *International Review of Research in Open and Distributed Learning*, *19*(3). https://doi.org/10.19173/irrodl.v19i3.3370

*Qiu, M., & Xu, Y. (2018). Assessing learning outcomes of a MOOC incorporated into an on-campus management information systems class. *Journal of International Technology and Information Management, 27*(1), 116-128. https://doi.org/10.58729/1941-6679.1368

*Rabin, E., Kalman, Y. M., & Kalz, M. (2019). An empirical investigation of the antecedents of learner-centered outcome measures in MOOCs. *International Journal of Educational Technology in Higher Education, 16*(1), 14. https://doi.org/10.1186/s41239-019-0144-3

*Rizvi, S., Rienties, B., Rogaten, J., & Kizilcec, R. F. (2019). Investigating variation in learning processes in a FutureLearn MOOC. *Journal of computing in higher education*, *32*(1), 162-181. https://doi.org/10.1007/s12528-019-09231-0

*Rodriguez, B. P., & Armellini, A. (2017). Developing self-efficacy through a massive open online course on study skills. *Open Praxis, 9*(3), 335-343. https://doi.org/10.5944/openpraxis.9.3.659

*Shapiro, H. B., Lee, C. H., Roth, N. E. W., Li, K., Çetinkaya-Rundel, M., & Canelas, D. A. (2017). Understanding the massive open online course (MOOC) student experience: An examination of attitudes, motivations, and barriers. *Computers & Education, 110*, 35-50. https://doi.org/10.1016/j.compedu.2017.03.003

*Singh, A. B., & Mørch, A. I. (2018). An analysis of participants' experiences from the first international MOOC offered at the University of Oslo. *Nordic Journal of Digital Literacy, 13*(01), 40-64. https://doi.org/10.18261/issn.1891-943x-2018-01-04

*Stich, A. E., & Reeves, T. D. (2017). Massive open online courses and underserved students in the United States. *The Internet and Higher Education*, *32*, 58-71. https://doi.org/10.1016/j.iheduc.2016.09.001

*Sun, G., & Bin, S. (2018). Topic interaction model based on local community detection in MOOC discussion forums and it's teaching application. *Kuram ve Uygulamada Egitim Bilimleri, 18*(6), 2922-2931. https://doi.org/10.12738/estp.2018.6.191

*Sunar, A. S., Abbasi, R. A., Davis, H. C., White, S., & Aljohani, N. R. (2018). Modelling MOOC learners' social behaviours. *Computers in Human Behavior*, 105835. https://doi.org/10.1016/j.chb.2018.12.013

*Swinnerton, B. J., Morris, N. P., Hotchkiss, S., & Pickering, J. D. (2017). The integration of an anatomy massive open online course (MOOC) into a medical anatomy curriculum. *Anatomical Sciences Education, 10*(1), 53-67. https://doi.org/10.1002/ase.1625

*Torres, W. J., & Beier, M. E. (2018). Adult development in the wild: The determinants of autonomous learning in a massive open online course. *Learning and Individual Differences, 65*, 207-217. https://doi.org/10.1016/j.lindif.2018.06.003

*Valdivia Vázquez, J. A., Ramírez-Montoya, M. S., Valenzuela González, J. R., Henderson, S., Conrad, D., McGreal, R., & Kennepohl, D. (2018). Motivation and knowledge: Pre-assessment and post-assessment of MOOC participants from an energy and sustainability project. *International Review of Research in Open and Distributed Learning, 19*(4), 116-132. https://doi.org/10.19173/irrodl.v19i4.3489

*van den Beemt, A., Buijs, J., van der Aalst, W., Henderson, S., Conrad, D., McGreal, R., & Kennepohl, D. (2018). Analysing structured learning behaviour in massive open online courses (MOOCs): An approach based on process mining and clustering. *International Review of Research in Open and Distributed Learning*, *19*(5). https://doi.org/10.19173/irrodl.v19i5.3748

*van de Oudeweetering, K., & Agirdag, O. (2018). Demographic data of MOOC learners: Can alternative survey deliveries improve current understandings? *Computers & Education, 122*, 169-178. https://doi.org/10.1016/j.compedu.2018.03.017

*Wang, L., Hu, G., & Zhou, T. (2018). Semantic analysis of learners' emotional tendencies on online MOOC education. *Sustainability, 10*(6), 1921. https://doi.org/10.3390/su10061921

*Wang, Z., Anderson, T., & Chen, L. (2018). How learners participate in connectivist learning: An analysis of the interaction traces from a cMOOC. *International Review of Research in Open and Distributed Learning*, *19*(1). https://doi.org/10.19173/irrodl.v19i1.3269

*Watson, S. L., Watson, W. R., Yu, J. H., Alamri, H., & Mueller, C. (2017). Learner profiles of attitudinal learning in a MOOC: An explanatory sequential mixed methods study. *Computers & Education, 114*, 274-285. https://doi.org/10.1016/j.compedu.2017.07.005

*Williams, K. M., Stafford, R. E., Corliss, S. B., & Reilly, E. D. (2018). Examining student characteristics, goals, and engagement in massive open online courses. *Computers & Education*, *126*, 433-442. https://doi.org/10.1016/j.compedu.2018.08.014

*Wong, J., Khalil, M., Baars, M., de Koning, B. B., & Paas, F. (2019). Exploring sequences of learner activities in relation to self-regulated learning in a massive open online course. *Computers & Education, 140*, 103595. https://doi.org/10.1016/j.compedu.2019.103595

*Wu, W. H., Kao, H. Y., Wu, S. H., & Wei, C. W. (2019). Development and evaluation of affective domain using student's feedback in entrepreneurial MOOC courses. *Frontiers in Psychology, 10*, 1109. https://doi.org/10.3389/fpsyg.2019.01109

*Xing, W. (2019). Exploring the influences of MOOC design features on student performance and persistence. *Distance Education*, *40*(1), 98-113. https://doi.org/10.1080/01587919.2018.1553560

*Yang, H. H., & Su, C. H. (2017). Learner behavior in a MOOC practice-oriented course: In empirical study integrating TAM and TPB. *The International Review of Research in Open and Distributed Learning, 18*(5), 35-63. https://doi.org/10.19173/irrodl.v18i5.2991

Appendix B. Overview of measurement instruments adopted in the study presented in Chapter 3

Table B.1.
Overview of measurement instruments adopted in the study presented in Chapter 3.

Variable	Item
Perceived learning support	
Course design	Please indicate your perceptions toward the MOOC you attended in the following aspects (1 - *Strongly disagree* to 6 - *Strongly agree*): 1. The course and learning materials are coherently organized and well structured. 2. The platform is user friendly. 3. The required effort and learning outcomes were well-matched in this MOOC.
Interaction with instructors	Please indicate your perceptions toward the MOOC you attended in the following aspects (1 - *Strongly disagree* to 6 - *Strongly agree*): 1. The instructor gave me feedback in the course of learning. 2. The instructor counseled and supported me in the course of learning. 3. When I needed help in the course of learning, I could get in personal contact with the instructor. 4. The instructor interact with students in the discussion forums.
Interaction with peer students	Please indicate your perceptions toward the MOOC you attended in the following aspects (1 - *Strongly disagree* to 6 - *Strongly agree*): 1. I could exchange information and knowledge easily and quickly with peer students. 2. The communication in the discussion forums facilitated exchange of information with peer students. 3. Learning in groups and cooperation with other learners were supported in the courses (e.g., discussion forums and peer-review). 4. There were ample opportunities in the course to establish personal contact with peer students (e.g., discussion forums, peer-review, and group work).

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Learner autonomy	Please indicate your perceptions toward the MOOC you attended in the following aspects (1 - *Strongly disagree* to 6 - *Strongly agree*): 1. I could individually decide what times and where I am learning this MOOC. 2. I could individually decide the use of learning strategies and the pace of learning. 3. This MOOC offers opportunities for self-paced chapter exercises and the application of one's knowledge. 4. This MOOC offers opportunities to control my learning outcomes (e.g. by self-tests).
Learning engagement	Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Never* to 5 – V*ery often*): 1. I watched video lectures to master the subject matter in this MOOC. 2. I read course materials to enhance the understanding of the subject matter in this MOOC. 3. I completed the assignments before the deadline. 4. I submitted the assignments before the deadline. 5. I participated in the course assessments to exam what I learned in this MOOC (e.g., tests, quizzes, and exams). 6. I posted my views on the topics in discussion forums. 7. I replied to others' comments in discussion forums. 8. I commented on others' posts in discussion forums. 9. I provided feedback to other course participants in peer-review. 10. I reflected on the peer feedback to improve coursework in peer-review.
Self-regulated learning strategies	
Elaboration	Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 – *Very untrue of me* to 6 – *Very true of me*): 1. When I become confused about something, I return to the video lectures and course materials and try to figure it out. 2. I try to relate ideas in this subject to those in other courses whenever possible. 3. When watching video lectures and reading course materials for this MOOC, I try to relate the content to what I already know.

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4. I try to understand the video lectures and course materials taught in this MOOC by making connections between the content and the concepts I can find in and outside this MOOC.
5. When studying video lectures and course materials for this MOOC I try to determine which concepts I don't understand well.
6. I try to apply ideas from video lectures and course materials in other course activities such as discussion forums.

Critical thinking

Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 – *Very untrue of me* to 6 – *Very true of me*):

1. I often find myself questioning things I hear or read in this MOOC to decide if I find them convincing.
2. When a theory, interpretation, or conclusion is presented in the video lectures, course materials, or discussion forums, I try to decide if there is good supporting evidence.
3. I treat the video lecture and course materials as a starting point and try to develop my own ideas about it.
4. I try to play around with ideas of my own related to what I am learning in this MOOC.
5. Whenever I read an assertion or conclusion in this MOOC, I think about possible alternatives.

Metacognitive self-regulation

Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 – *Very untrue of me* to 6 – *Very true of me*):

1. When watching video lectures and reading course materials for this MOOC, I make up questions to help focus my watch and reading.
2. If video lectures and course materials are difficult to understand, I change the way I watch the lectures and read the material.
3. Before I study new video lectures and course materials thoroughly, I often skim it to see how they are organized.
4. I ask myself questions to make sure I understand the video lectures and course materials taught in this MOOC.
5. I try to change the way I study in order to fit the course requirements and the instructional methods used in this MOOC.
6. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying for this MOOC.
7. When I study for this MOOC, I write brief summaries of the main ideas from the video lectures, course materials.

	8. When I study for this MOOC, I set goals for myself in order to direct my activities in each session.
Time and environment management	Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 – *Very untrue of me* to 6 – *Very true of me*): 1. I usually study in a place where I can concentrate on my course work. 2. I make good use of my study time for this MOOC. 3. I find it hard to stick to a study schedule in this MOOC. 4. I have a regular place set aside for studying this MOOC. 5. I make sure that I keep up with the weekly sessions and assignments for this MOOC. 6. I often find that I don't spend very much time on this MOOC because of other activities. 7. I rarely find time to review my notes, video lectures, or course materials.
Perceived learning outcomes	Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly disagree* to 6 - *Strongly agree*): 1. I have understood the video lectures and course materials taught in this MOOC. 2. I have learned the knowledge taught in the subject matter. 3. This MOOC expands my knowledge and skills of the subject. 4. I have developed skills on how to apply the knowledge in this MOOC. 5. I have developed the skills of communication and cooperation in this MOOC. 6. I have developed the skills of self-regulated learning in this MOOC. 7. I am pleased with what I learned in this MOOC. 8. I am appreciated the interaction with the instructor in this MOOC. 9. I am appreciated the interaction with peer students in this MOOC.

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Appendix C. Overview of measurement instruments adopted in the study presented in Chapter 4

Table C.1.
Overview of measurement instruments adopted in the study presented in Chapter 4.

Variable	Item
Attitudes	Please indicate your perceptions toward learning in MOOCs in the following aspects (1 - *Completely inapplicable* to 5 - *Completely Applicable*): 1. Learning in MOOCs makes my study more satisfying. 2. I like learning in MOOCs. 3. I feel more motivated when I am learning in MOOCs. 4. Because of learning in MOOCs, my study becomes more efficient. 5. Learning in MOOCs in an effective way enhances my learning productivity. 6. Learning in MOOCs improves my academic performance.
Self-efficacy	Please indicate your perceptions toward learning in MOOCs in the following aspects (1 - *Very untrue of me* to 5 - *Very true of me*): 1. I believe I can learn a lot in MOOCs. 2. I am certain I can understand the most difficult material presented in MOOCs. 3. I am confident I can learn the basic concepts taught in MOOCs. 4. I am confident I can understand the most complex material presented in MOOCs. 5. I am confident I can do an excellent job in MOOCs. 6. I expect to do well in MOOCs. 7. I am certain I can master the skills being taught in MOOCs. 8. Concerning the difficulty of MOOCs and my skills, I think I can do well in MOOCs.
Task value	
Intrinsic value	Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*): 1. This MOOC is interesting to me. 2. I find studying for this MOOC is interesting.

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3. Compared to other courses, I like this MOOC very much.
4. I am fascinated by this MOOC.
5. I enjoy this MOOC.
6. This MOOC is exciting to me.
7. I like this MOOC.

Attainment value

Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*):

1. Being good at solving problems in this MOOC is important to me.
2. Compared to other courses, doing well in this MOOC is important to me.
3. Being someone who does well at this MOOC is important to me.
4. Doing well at this MOOC is an important part of who I am.

Utility value

Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*):

1. This MOOC is useful for what I want to do after I graduate.
2. This MOOC will be important when I get a job or go to graduate school.
3. This MOOC will be useful for me later in life.
4. What I am learning in this MOOC is useful because they will help me in the future.

Perceived cost

Task effort cost

Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*):

1. This MOOC demands too much of my time.
2. I have to put too much energy into this MOOC.
3. This MOOC takes up too much time.
4. This MOOC is too much work.
5. This MOOC requires too much effort.

Loss of valued alternatives

Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*):

1. I have to sacrifice too much to be in this MOOC.

2. This MOOC requires me to give up too many other activities I value.
3. Taking this MOOC causes me to miss out on too many other things I care about.
4. I can't spend as much time doing the other things that I would like because I am taking this MOOC.
5. I pay attention to this MOOC.

Emotional cost

Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*):

1. I worry too much about this MOOC.
2. This MOOC is too exhausting.
3. MOOC is emotionally draining.
4. This MOOC is too frustrating.
5. This MOOC is too stressful.
6. This MOOC makes me feel too anxious.

Learning engagement

Cognitive Engagement

Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*):

1. When doing coursework in this MOOC, I try to relate what I'm learning to what I already know.
2. I study this MOOC, I try to connect what I am learning with my own experiences.
3. I try to make all the different ideas fit together and make sense when I study this MOOC.
4. I make up my own examples to help me understand the important concepts I study in this MOOC.
5. Before I begin to study this MOOC, I think about what I want to get done.
6. When I'm working on my coursework in this MOOC, I stop once in a while and go over what I have been doing.
7. As I study this MOOC, I keep track of how much I understand, not just if I am getting the right answers.
8. If what I am learning in this MOOC is difficult to understand, I change the way I learn the material.

Behavioral Engagement	Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*): 1. I study this MOOC carefully. 2. I try hard to do well in this MOOC. 3. When I start a new topic in this MOOC, I learn it very carefully. 4. I work hard when I start something new in this MOOC. 5. I pay attention to this MOOC.
Emotional Engagement	Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*): 1. I enjoy learning new things in this MOOC. 2. When I work on something in this MOOC, I feel interested. 3. When I study this MOOC, I feel curious about what I am learning. 4. This MOOC is fun. 5. When I work on something in this MOOC, I get involved.
Perceived learning outcomes	Please indicate how you feel about learning in the MOOC you attended in the following aspects (1 - *Strongly Disagree* to 5 - *Strongly Agree*): 1. I have understood the content and concepts in the subject matter of this MOOC. 2. I have learned the knowledge taught in the subject matter of this MOOC. 3. This MOOC expands my knowledge of the subject. 4. I have developed skills on how to apply the knowledge in this MOOC. 5. I have developed the skills of communication and cooperation in this MOOC. 6. I have developed the skills of self-regulated learning in this MOOC. 7. I am pleased with what I learned in this MOOC. 8. I am appreciated the interaction with the instructor in this MOOC. 9. I am appreciated the interaction with peer students in this MOOC.

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