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Kemmis, S., & Smith, T. J. (Eds.). (2008). Enabling Praxis: Challenges for Education. Sense Publishers.

Kretchmar, K., & Zeichner, K. (2016). Teacher prep 3.0: A vision for teacher education to impact social transformation. Journal of Education for Teaching, 42(4), 417–433. https://doi.org/10.1080/02607476.2016.1215550

Ma, H., & Green, M. (2021). The Affordance of Place in Developing Place-Responsive Science Teaching Pedagogy: Reflections from Pre-Service Teachers. Journal of Science Teacher Education, 32(8), 890–910. https://doi.org/10.1080/1046560X.2021.1898139

Mahon, K., Heikkinen, H. L. T., Huttunen, R., Boyle, T., & Sjølie, E. (2020). What is Educational Praxis? In K. Mahon, C. Edwards-Groves, S. Francisco, M. Kaukko, S. Kemmis, & K. Petrie (Eds.), Pedagogy, Education, and Praxis in Critical Times (pp. 15–38). Springer. https://doi.org/10.1007/978-981-15-6926-5_2

Nguyen, C. D., & Dang, T. C. T. (2020). Second Language Teacher Education in Response to Local Needs: Preservice Teachers of English Learning to Teach Diverse Learners in Communities. TESOL Quarterly, 54(2), 404–435. https://doi.org/10.1002/tesq.551

Oughton, H. (2010). Funds of knowledge—A conceptual critique. Studies in the Education of Adults, 42(1), 63–78. https://doi.org/10.1080/02660830.2010.11661589

Popielarz, K., & Galliher, A. (2023). Developing accountability and responsibility: How teacher candidates experience and conceptualize community-based pedagogy in the social studies. Theory and Research in Social Education, 51(1), 100–127. https://doi.org/10.1080/00933104.2022.2135471

Smith, G. A., & Sobel, D. (2010). Place- and Community-Based Education in Schools: Place and Community-Based Education in Schools. Taylor & Francis Group.

Somerville, M., Plunkett, M., & Dyson, M. (2010). New teachers learning in rural and regional Australia. Asia-Pacific Journal of Teacher Education, 38(1), 39–55. https://doi.org/10.1080/13598660903474130

Thomas, T. G. (2020). Place-based inquiry in a university course abroad: Lessons about education for sustainability in the urban outdoors. International Journal of Sustainability in Higher Education, 21(5), 895–910. https://doi.org/10.1108/IJSHE-07-2019-0220

Zeichner, K. M. (2017). The Struggle for the Soul of Teacher Education. Routledge. https://doi.org/10.4324/9781315098074

Zipin, L. (2009). Dark funds of knowledge, deep funds of pedagogy: Exploring boundaries between lifeworlds and schools. Discourse: Studies in the Cultural Politics of Education, 30(3), 317–331. https://doi.org/10.1080/01596300903037044

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120 Evolving professional development in nuclear reactor physics and safety through hybrid learning environments

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Research Domains

Academic practice, work, careers and cultures (AP)

Abstract

Nuclear education providers have difficulties sustaining their programs that typically consist of small cohorts of students and tend to follow a traditional, lecture-based design. This paper presents the GRE@T-PIONEeR project as a response aiming to preserve competencies and skills in computational and experimental nuclear reactor physics and nuclear safety through the implementation of six advanced courses offered globally to PhD and Post-Doc students, nuclear professionals, and MSc students. The courses employ a flipped classroom approach within a hybrid learning environment, complemented by three hands-on training sessions on nuclear training reactors. The courses were evaluated using validated survey instruments associated with various learning-theoretical frameworks. The paper presents preliminary findings derived from one of the courses comprising asynchronous online and synchronous hybrid sessions. While course completion and performance were high both among onsite and online students, some notable distinctions between the two groups emerge. Future research will explore these differences further.

Full paper

The dynamics of knowledge in society have significantly impacted the conditions of professional work and learning, including the field of engineering (Nerland, 2018). This becomes especially evident in the context of modern engineering, where engineers are tasked with designing innovative solutions that incorporate cutting-edge technology, that often requires a deep understanding of the latest advancements (Crawley et al., 2007). One of these areas is nuclear engineering, where the advent of affordable computing power has significantly augmented the significance of modeling and simulations. However, European nuclear engineering programs are in a state of crisis and need innovative changes to face an alarming decline in student enrollment and to keep up with the increasing demand for skilled labor. Nuclear education providers have difficulties sustaining their programs that typically consist of small cohorts of students. Courses tend to follow a traditional, lecture-based design, which can present significant obstacles to participation and learning. A potential solution is provided through the collaborative provision of online learning programs with greater accessibility and flexibility. But online learning often suffers from low levels of student engagement and high drop-out rates (Eriksson et al., 2017). Hence, an ongoing imperative exists to develop and assess learning designs that aim to address the limitations of both online and traditional courses while capitalizing on their inherent strengths through hybrid configurations.

The GRE@T-PIONEeR project aims to follow this call and preserve competencies and skills in computational and experimental nuclear reactor physics and nuclear safety (Demazière et al., 2021). Ten partners from six European countries developed a series of six advanced courses offered globally to MSc and PhD students, Post-Doc, and nuclear professionals. The courses are conducted as online and hybrid versions and based on the (online) flipped classroom method (Stöhr & Adawi, 2018) and principles of active learning (Freeman et al., 2014). In the beginning of a course, participants submit an honor code agreement, and the courses are offered free of charge. The courses consist of preparatory asynchronous (online) sessions comprising activities such as a series of handbooks, short video lectures, and online quizzes as well as synchronous sessions, where participants either participate in-class or online. The sessions include a combination of individual and collaborative active learning activities.

As part of a PhD project, a research design was developed that aims to better understand the effects of this digitalized learning environment on learners and their learning. In addition to data on motivation and learner background, learning analytics data was collected on learner activity and performance from the Moodle-based learning management system. Further, a learner survey instrument was designed building on four relevant learning theories focusing on different aspects of the learning process – the Community of Inquiry framework (Garrison et al., 1999), Transactional Distance Theory (Moore, 2013), Self-regulated Learning theory (SRL) (Zimmerman, 2002), and the ARCS Model of Motivation (Keller, 1983). The survey combined validated standard instruments from each theoretical perspective and some questions about course satisfaction. After pretesting and some re-adjustments, the survey was distributed after each course module. About 50 learners participated in each module of which approx. 50% responded to the survey.

Although the analysis just started, some initial results can be reported about learner activity, performance, and satisfaction from one of the modules titled "Core Modelling for Core Design," which will be supplemented during the presentation at the conference. Regarding performance, the course completion rate was slightly above 50%, which is interpreted as a good result given the advanced course level and the high drop-out rates in other online courses. Pure online participants demonstrated considerably more strategic behavior with many just passing the required minimum, whereas onsite learners often reached maximum points. This disparity is also reflected in the activity measurements. While overall completion of the different learning activities was high, online learners showed a significantly lower completion rate, particularly during the synchronous sessions. These effects are presumed to be influenced by online participants' need to balance their participation with other commitments. There could also be motivational differences or effects of SRL (Stöhr et al., 2020), underlining the need for further analysis. However, participants (both online and hybrid) expressed exceptionally high levels of satisfaction with the course. In sum, the study affirms the pedagogical advantages of the flipped classroom and demonstrates how the hybrid learning design broadens access for learners while maintaining a high level of learner retention. Further research will explore the observed patterns further.

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References

Crawley, E. F., Malmqvist, J., Östlund, S., & Brodeur, D. R. (2007). Overview. In E. F. Crawley, J. Malmqvist, S. Östlund, & D. R. Brodeur, Rethinking Engineering Education The CDIO Approach (pp. 6–44). Springer New York, NY. https://doi.org/10.1007/978-3-319-05561-9_2

Demazière C., Cabellos O., Garcia-Herranz N., Dulla S., Miró R., Macian R., Szieberth M., Buchet E., Maurice S., and Errecart F. (2021). GRE@T-PIONEeR: Teaching computational and experimental reactor physics using innovative pedagogical methods. Proceedings of the International Conference on Nuclear Education and Training (NESTet2021), hybrid, Brussels, Belgium, November 15-17, 2021, European Nuclear Society.

Eriksson, T., Adawi, T., & Stöhr, C. (2017). "Time is the bottleneck": A qualitative study exploring why learners drop out of MOOCs. Journal of Computing in Higher Education, 29(1), 133–146. https://doi.org/10.1007/s12528-016-9127-8

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences, 111(23), 8410–8415. https://doi.org/10.1073/pnas.1319030111

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

Keller, J. M. (1983). Motivational design of instruction. Instructional Design Theories and Models: An Overview of Their Current Status, 1(1983), 383–434.

Moore, M. G. (2013). The theory of transactional distance. In Handbook of distance education (pp. 84–103). Routledge.

Nerland, M. (2018). Knowledge practices and relations in professional education. Studies in Continuing Education, 40(3), 242–256. https://doi.org/10.1080/0158037X.2018.1447919

Stöhr, C., & Adawi, T. (2018). Flipped Classroom Research: From "Black Box" to "White Box" Evaluation. Education Sciences, 8(1), 22. https://doi.org/10.3390/educsci8010022

Stöhr, C., Demazière, C., & Adawi, T. (2020). The polarizing effect of the online flipped classroom. Computers & Education, 147, 103789. https://doi.org/10.1016/j.compedu.2019.103789

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