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PREP- Pragmatic Research on Educational Practice

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1 ABSTRACT

We investigate a concept called PREP – Pragmatic Research on Educational Practice, with the goal of engaging engineering educators in studying, documenting and sharing their initiatives to improve teaching practices. This concept is compared to other methodologies where the researcher and educational practitioner sometimes coincide. The study is based on a pilot, with six participants following the PREP program for three months, which we study autoethnographically. We also carried out a focus group discussion (n=12) to investigate to what extent university teachers regard the ideas from the PREP program as helpful for studying educational activities and sharing what they do and find.

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2 INTRODUCTION

2.1 Rationale

University teachers play a crucial role in shaping students' educational experiences and outcomes. They are responsible for creating learning environments that foster student success, including delivering instruction and designing assessments. In the last decades, there has been an increasing emphasis on evidence-based practice in higher education (Groccia and Buskist 2011; Council et al. 2012). However, most teachers involved in engineering education are not educational scholars. They are teaching practitioners that choose their design based on their situation, traditions, preferences, and ideas, less often directly based on research (Slavin 2008). There seems to be a gap between institutional ambitions and the reality for most university teachers involved in engineering education.

On the other hand, our experience is that plenty of ambitious engineering educators try out different pedagogical ideas in their teaching and strive to understand the effects of the implementations to see if they improve the learning experiences, quality, or outcomes in their courses. They do this within the limitations of their time and the course they teach. What they learn from this is often only shared with their closest colleagues.

We believe there is a need for a new form of educational study that can fit the time limitations of higher education teachers. These studies should let them document and disseminate what they already do when working to improve their courses and trying to understand the effects. This goes beyond course development work. It means being part of a community where ideas and results are shared, albeit in a less elaborate format than in regular educational research. It also means committing to being open and transparent about the methods used and the results obtained. To avoid publication bias, it is desirable that also failed attempts are documented and shared.

Results found in this form of study should not be considered equal to regular educational studies and will not generally meet the criteria of educational research journals. For example, due to constraints, teachers cannot be expected to set up control groups, have randomised or large samples, or conduct in-depth interviews. Still, there is value in documenting studies of this form as they will contribute to a pool of outcomes that can be accessed by teachers looking for inspiration and researchers looking for collective patterns. It is also possible that data can be collected from several such projects to be used in more extensive studies. For the individual teacher, benefits include becoming part of a community and turning development efforts into visible merit. For the engineering education community, ideas and results gain exposure, enabling higher-quality education.

In line with this idea, we suggest Pragmatic Research in Educational Practice, PREP (Bengmark 2022).

2.2 PREP - Pragmatic Research in Educational Practice

A PREP study has three characteristics. First, it is pragmatic, i.e. it uses what the engineering educator can see or do within his or her teaching practice, most often within one university course instance. It accepts that ensuring course quality for current students means that the teacher can most often not have control groups or eliminate confounding variables. Second, it is research-oriented in the sense that it is systematic, open, and shared for others to evaluate. Indeed, the main focus is on reporting about the teaching ideas and on what effects are found so that others can replicate or modify and share their result. A single PREP report does not constitute a research paper in the classical sense. However, high scientific rigour can be reached by considering the cumulative results from several PREP reports. An ambition is that when the volume of PREP studies on a specific topic reaches some critical threshold, researchers in education can use PREP studies as part of more rigorous studies of high scientific value. Finally, PREP studies are all about educational practice. They spring from aspects that a teaching practitioner wants to improve or understand by examining educational issues and ideas in their natural environment.

To support the process of conducting PREP studies, PREP groups consisting of a handful of engineering educators teaching during the same period are formed. Each member typically conducts an individual study, possibly in different subjects and at different universities. The idea is that by describing their PREP study and reporting on the progress within the group, the members commit to their studies and prioritise them higher within their work agenda. Also, getting suggestions and ideas from group members can help in overcoming hurdles.

We recommend that a PREP group meet at least three times, in person or online. At the first meeting, the kick-off, each member formulates what they want to try out in their course, some initial thoughts about how the effect should be measured, and ideas on what data should be used. This can be done by answering the following three questions: What am I curious about? What am I going to test in my teaching? What data could help me determine the effect? The other group members react with ideas, suggestions, or references. At the second meeting, mid-course, the members report on their progress, maybe by answering the following questions: What have I done so far? What do I plan to do in the near future? What is stopping me? The other group members help with ideas on how to continue. The third meeting is to support the analysis of the data. Each member describes the data found and their interpretation of it. This is then discussed with the group.

Finally, each member completes their reports. To facilitate this step, reports follow a template filled in online and stored in a designated PREP repository that is searchable and public. The template has the following eight parts: 1. Title; 2. Microabstract; 3. Personal data, including name and contact details; 4. Course information, including subject content, level, size, and a description of the intervention or aspect studied; 5.

The study, including the purpose and study questions, data collection, and analysis; 6. Results and conclusions, such as quotes, graphs, tables, and the author's interpretation of the data; 7. Practical implications such as things to avoid; 8. Other, e.g. references to proven experience or literature. The documentation of a PREP study emphasises the description of the teaching activities, as these need to be understood by educators from other regional or organisational traditions for them to be able to reproduce the teaching activities.

The threshold for publishing, i.e. documenting a PREP study, differs from that of regular scientific journals. For example, unsuccessful or incomplete studies are welcome: as long as they are well-documented, the ideas behind unsuccessful or incomplete studies may interest others. There are lessons to be learned from why a study was not completed. Studies with unclear results are also welcome, as the results may become clearer through replications.

2.3 Research questions

This study investigates how engineering educators view PREP as a tool for studying, documenting and sharing their teaching practice. Hence, we have formulated the following research questions.

RQ1 What are the benefits of PREP, according to engineering educators, i.e. what aspects of the PREP program do they consider to be helpful for studying, documenting and sharing their pedagogical ideas and practices?

RQ2 What aspects of the PREP program need improvement, according to engineering educators?

3 OTHER METHODOLOGIES AND PROVEN EXPERIENCE

Several well-established research methodologies focus on improving teaching and learning practices and where the researcher and educational practitioner may coincide. Design-Based Research, DBR, is a methodology that involves the iterative development and testing of educational interventions in authentic educational settings (Anderson and Shattuck 2012). Design Experiments and Design Research are established methodologies that involve the intentional design of educational interventions or systems and seek to generate evidence for the effectiveness of these activities (Cobb et al. 2003). Action Research is a methodology that involves the active engagement of practitioners in conducting research to inform their practice. It uses a cyclical process of reflecting, planning, action, and observing and aims to improve practice through self-reflection and self-directed inquiry (Noffke 2009; Ivankova 2015). Finally, there is the scholarship of teaching and learning (SoTL) which is a process that involves six steps: framing an investigation question, identifying a relevant teaching/learning framework, devising an intervention, conducting the investigation, producing a result with some form of public artefact and inviting peer review (Trigwell 2021).

All these methodologies have similarities with PREP as they involve practitioners and their daily educational settings, not least in Action Research which explicitly involves the practitioner in doing the research, while this may be the case also in the other methodologies. SoTL has significant similarities with PREP as it encourages practitioners to research their teaching. However, there are some major differences. One is that PREP does not expect iterative development within a single PREP study. Iterations are left for consecutive PREP studies, maybe by other authors. In PREP, there is also no need for new designs or interventions. Although this may be the focus in some PREP studies, others may study what is already happening within a course. The main difference compared with all the above methodologies is that PREP moves some of the responsibility for the scientific process from individual authors to the PREP community. An individual PREP study does not meet the scientific rigour expected by studies using the other methodologies mentioned above, including SoTL (Boshier 2009). PREP recognises that university teachers face challenges in finding time and expertise to conduct high-standard educational research. It offers a more pragmatic approach that does not require extensive planning or intervention development. However, in PREP, replications play a significant role. Hence, each PREP study needs a detailed description of the teaching activities studied to make replications possible. Finding patterns among replications and similar studies can be the task of meta-studies. Several PREP studies together can form the basis for more carefully conducted scientific studies.

In practical fields, such as education or health care, practitioners also rely on Proven Experience. This refers to the knowledge and insights gained through years of practice and reflection, shared among colleagues. While proven experience can offer valuable insights and inform teaching practices, it lacks the systematic and transparent nature of educational research. PREP offers a more structured approach that aims to be a systematic and transparent research process together with a structured way of disseminating the results.

In summary, PREP offers a novel approach that engages teaching practitioners in educational research and development at a level less demanding than existing research methodologies but more systematic and transparent than proven experience.

4 METHODOLOGY

Two data sets are collected, one from a pilot where a group of educators followed the PREP program and one from a focus group discussion about PREP with engineering educators.

4.1 The pilot

An autoethnographic study is a form of qualitative case study that explores the researchers' personal experiences and reflections on a particular phenomenon. Data can be collected through a combination of self-reflection, interviews with others, and

analysis of relevant documents (Le Roux 2017). This method was chosen to get an inside view of the possibilities and obstacles when studying teaching practices following the PREP process.

A PREP group was formed with six educators from three universities. The group completed a full PREP cycle during a three-month period in the spring of 2023, including the three meetings recommended for a PREP group and the documentation of studies. The four authors of this paper were part of this activity, in this text referred to as the PREP pilot or just the pilot. In focus was what helped and hindered the participants in their attempts to complete their studies and document them. During the process, the authors continuously reflected on how the PREP process influenced their teaching practices and educational research activities. This was subsequently discussed and documented in this report.

4.2 Focus group

A focus group is a qualitative research tool that involves a group of participants engaging in structured discussions facilitated by a researcher. This method allows for an in-depth exploration of participants' perspectives and experiences and promotes group dynamics and interaction that can generate rich data (Gibbs 2012).

A focus group session was conducted as part of a pedagogical conference at a technical university. This was a convenience sample as the participants chose this session voluntarily. At the beginning of the session, the participants were asked for consent to participate in this study. The focus group consisted of 12 university teachers in engineering education from one and the same university, active in various disciplines. Among the participants, three had no prior experience conducting research connected to their teaching, six had participated in studies but never shared educational research results with others, and the remaining three had completed and presented educational research findings at conferences for teaching practitioners.

The focus group session used a structured interview guide developed by the researchers. To let each participant develop their own understanding, the participants were asked to respond to the questions individually first, either digitally or on paper. The interview guide included both multiple choice questions, where the participants had to take a stand, and open-ended questions that aimed at collecting a wide variety of ideas and experiences expressed by the respondents, both concerning engagement in educational research related to their teaching practice and their opinions about the PREP program. The moderator facilitated the discussion, encouraged participants to share their thoughts and experiences, and probed for further elaboration when needed. The data from the focus group session consisted of the answers given in writing and notes taken by the researchers during the session.

The data from the focus group discussion was analysed by the authors and compared with the experience from the PREP pilot.

5 RESULTS AND DISCUSSION

5.1 RQ1: Benefits of PREP

The analysis of the focus group discussion yielded three challenges that engineering educators see regarding their engagement in educational research on their teaching practice. These are lack of time, lack of know-how, and lack of motivation. The focus group data and experience from the pilot both point to aspects of the PREP program that may help overcome these challenges.

The focus group discussion pointed to lack of time as a significant challenge when it comes to conducting educational research. Busy schedules, heavy workloads, and other professional commitments left participants with limited time to engage in educational research activities. Time was also clearly a struggle for the members participating in the pilot. Of the six members of the group, four took part till the end of the process. Three of these have so far completed their PREP documentation, reflecting a lack of time. However, none of them believes they would have had time to complete a regular educational research study during that period.

The focus group found the PREP approach to be simple and time effective as it builds on existing activities. The extra time needed, on top of what is already invested in the course development, is kept to a minimum. Not being expected to do a full educational study makes it more feasible, as many engineering educators do not have time dedicated to educational research in their job description. None of the people engaged in the pilot had special time designated for participation in the PREP. However, using things that they wanted to do as course development, with some additional time invested, four of them completed the cycle. One of the authors that completed the documentation estimated that the time used for filling in the template was two hours.

Another challenge that surfaced in the focus group discussion was the lack of expertise in educational research. Participants felt that conducting educational research required specific skills and knowledge that they did not possess regarding research design, data collection, and data analysis.

That a PREP study is not expected to live up to the high scientific standards of regular educational research reduces the barrier, according to the focus group. Participants found it encouraging that a PREP study may become part of collective evidence together with other PREP studies. The focus group also touched upon the possibility that the lack of expertise can be partly compensated by the collaborative nature of the PREP approach, as colleagues provide ideas and support. Engaging in discussions and receiving feedback from peers may help them refine their ideas and improve their

pragmatic research projects. Even if all the members of the pilot had some experience in educational research, they had great help from each other, in particular getting ideas on data collection and suggestions on literature to read.

A third challenge for engineering educators is a lack of motivation to do educational research. As teaching practitioners, the focus group claimed that their main motivation is to develop their teaching. The focus in PREP on educational practice can therefore be a bridge if convinced that engagement in pragmatic research can be a valuable professional development activity that enhances teaching quality. The relevance of the projects for their teaching practice was a great motivator for all members of the pilot. Three of them studied aspects of their ongoing course that they wanted to improve to make teaching and learning better. The fourth member changed PREP projects mid-way in order to shed light on questions raised during discussions at the PREP meetings, using data that had been collected during a previous course but had not been properly analysed and documented.

Another aspect that can boost motivation, according to the focus group, is the social aspect of PREP, i.e. being part of PREP groups. This was definitely the case for the members of the pilot. Knowing that one soon shall tell the group about the progress was often the reason the pilot members took the next steps in their studies, despite very full work schedules.

Finally, the question of recognition was also discussed. Regular educational research is most often recognised in the academic system but takes an effort that is beyond what many engineering educators can muster. On the other hand, doing course development fits into their work life but gives no visible academic reward. That a PREP study in the future could be perceived as a merit within their academic community and contribute to career advancement, was seen as a valuable aspect of PREP for the participants in the focus group. For the members of the pilot, there is not yet much career merit from their PREP studies, but their drive was to contribute to give it recognition in the future.

5.2 RQ2: Improvements needed

During both the focus group discussion and the pilot, aspects of PREP that need improvement were discussed. From these discussions, we have extrapolated two major concerns, scientific rigour and the governing of PREP.

Participants in the focus group expressed concerns about the scientific rigour of PREP studies. Indeed, there was a concern that professional educational researchers or others would object if engineering educators did educational research with lowered

standards. One member asked: If a PREP study does not meet scientific standards, what is its value? However, since educational science is a collective negotiation where one research study seldom settles the dispute, there is also a need for reproduction and contrasting views involving many scientists and studies in regular educational science. We argue that PREP studies can contribute to such a negotiation through meta-studies.

In PREP, there is no explicit demand to include references to the research literature. This is provocative, according to some members of the focus group. Not acknowledging what is already known would be unacceptable in regular research. However, the level of connection to previous research in PREP studies may vary. Some might build their study's design on research they refer to. Others may want to replicate an earlier study without delving into the scientific literature that was the foundation for the original study. We argue that such studies should be included as they also have an essential role within the PREP program. On the other hand, meta-studies, using PREP studies as study objects, definitely need a good foundation in the literature.

Hence, if we want to get support for PREP among practitioners and educational researchers, it has to be made very explicit that people involved in PREP are not sloppy researchers. They are practitioners involved in pragmatic research that puts the weight of evidence on the shoulders of the community of researchers. If claims are to be made using PREP studies, it has to involve meta-studies conducted in rigorous scientific manners. It is important that the PREP program does not contribute to a devaluation of the scientific method in the eyes of research colleagues or the general public. Instead, it should contribute to raising the value of educational research among practitioners, and among other stakeholders, as they see teachers striving to understand their teaching practice and a community collaborating and collecting bits of evidence on the effects of teaching practices.

The focus group discussed how the coordination of PREP programs should be organised. There seems to be a need for an organisational body responsible for running a repository, accepting submissions, developing the document template, and connecting people to form PREP groups. This was also discussed during the pilot. The discussions led to the following conclusions.

There is a need to continue to develop the documentation template from its current form to ensure usefulness for both authors and readers of PREP studies. Submitting a PREP study should be as simple as filling in the template online. There needs to be a basic review system to avoid spam and unsuitable material in the repository. Another question is, if and how to evaluate the quality of PREP studies to guide readers. Maintaining and administrating peer review is time-consuming. An alternative could be a system of endorsements or citations by members of the community. Also, the repository should be publicly available, but with login for submissions. It should be

well-structured and easy to search, both when searching for a relevant study and when gathering collections of related or similar studies. Each study, or collection of studies, should be easily referenced by researchers in a manner that is stable over time.

The power of sharing data within the PREP community was discussed in the focus group and during the pilot. That would enable using data from many PREP studies to form bigger data sets that can be used for regular research. This was considered an attractive idea with great possibilities. However, it is not included in the PREP program suggested here due to ethical issues which need further investigation.

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