Using Real-world Scenarios to Bridge Training and Practice in Evidence-Based Software Engineering

Sebastián Pizard[1], **Leticia Marenco**[1]

[1]Instituto de Computación – Universidad de la República
Av. Julio Herrera y Reissig 565 – 11300 Montevideo – Uruguay

spizard@fing.edu.uy, letims@gmail.com

Abstract. *Context: Training is crucial for the adoption of Evidence-Based Software Engineering (EBSE), but there is a gap in its integration with professional practice. Objective: To investigate the creation and use of scenarios that enhance EBSE training by simulating the application of evidence in real-world situations. Method: A mixed methods study was conducted, starting with consultations with three Uruguayan industry and government practitioners to create a practical scenario, followed by its use to improve an EBSE course. Results: Scenario development is challenging, primarily due to limitations of evidence, but their use enhances students' ability to apply evidence. Conclusions: Using scenarios to align EBSE training with practice seems to be feasible & effective.*

1. Introduction

Evidence-Based Software Engineering (EBSE) seeks to enhance decision-making in software development by combining the best research evidence with practical experience and human values [Kitchenham et al. 2004]. EBSE is widely accepted by researchers, as shown by Kamei et al.'s identification of 446 Systematic Reviews (SRs) published in leading software engineering (SE) journals and conferences before 2019 [Kamei et al. 2021]. However, its adoption in non-academic settings remains limited [Kitchenham et al. 2015, Hassler et al. 2014, Da Silva et al. 2011].

In other fields where Evidence-Based Practice (EBP)—the broader framework from which EBSE is derived—is being studied, adequate training has been recognized as crucial. SRs highlight that a lack of knowledge and skills is one of the most common barriers to EBP adoption [Upton et al. 2014, Scurlock-Evans and Upton 2015, Zwolsman et al. 2012, Sadeghi-Bazargani et al. 2014].

Motivated by this, we launched a research program to improve EBSE adoption through the development and evaluation of a university-level training initiative. The previous stages of our research involved:

- Conducting an SR on previous EBSE training initiatives, designing an EBSE course based on learning outcomes that encapsulate the knowledge and skills required for future EBSE practitioners, and delivering and evaluating the course based on student performance and their initial feedback after the course [Pizard et al. 2021].
- Conducting a longitudinal case study to analyze the EBSE course and its impact. This included collecting data at the end of each EBSE course (delivered in 2017, 2018, and 2019) and through two follow-up surveys conducted seven months and twenty-one months after the final course, respectively [Pizard et al. 2022].

Our recent studies provide evidence that gaining an understanding of EBSE enables participants to improve their information literacy skills [Pizard et al. 2022, Pizard et al. 2023]. This can be attributed to several factors, but it is likely that, after becoming familiar with EBSE, participants develop an awareness of the quality of the information underpinning decision-making in SE, as well as the level of rigor applied in its generation. Other studies also confirm that Rapid Reviews—a lightweight form of SR designed for resource-constrained environments—and their results can be successfully used by researchers to collaborate with practitioners [Cartaxo et al. 2018, Pizard et al. 2025], or by practitioners with strong research skills [Milewicz et al. 2023], to address real-world problems using evidence.

We aim to explore another way to take advantage of the benefits of EBSE: supporting practitioners in using SR evidence to address problems in their professional practice. In particular, in this paper, we report our research aimed at better integrating EBSE training with practice by evaluating using scenarios that simulate the application of evidence in real-world professional situations.

This paper is structured as follows. In Section 2 we introduce the integration of professional practice into EBP training, the concept of scenarios, and summarize EBSE training initiatives and their relationship with practice. Section 3 outlines the EBSE & SRs course in which this study was conducted, along with the context in which it was delivered. In Section 4, we specify our research objectives and describe the research strategy used to address them. The results are presented and discussed in Section 5. Finally, we present our conclusions in Section 6.

2. Related Work

EBP training in medicine has been shown to be more effective when it is integrated or supported with clinical practice [Ilic and Maloney 2014, Larsen et al. 2019, Coomarasamy and Khan 2004], as a result of bringing practitioners even closer to scientific evidence. A commonly used method to achieve this is to apply evidence to clinical cases, clinical scenarios, or case studies [Swanberg et al. 2016].

In particular, Manns and Darrah use the term *scenario* to refer to a specific clinical situation or case that is constructed to assess the use of EBP in clinical decision-making [Manns and Darrah 2012]. These scenarios are carefully designed and developed to represent real-world clinical situations. They serve as a tool to evaluate whether individuals can recognize and apply the various components of EBP in their decision-making process.

Before creating our EBSE course, we conducted an SR on EBSE and SR training, which was last updated in December 2019 [Pizard et al. 2021]. In that review, we identified 14 initiatives for teaching EBSE to undergraduate and graduate students [Pizard et al. 2021]. The studies reported EBSE training courses with postgraduate and undergraduate students conducted by universities in seven countries (Brazil, Canada, Italy, Norway, Turkey, the UK, and the USA) prior to 2014. Each study included a practical assignment, typically involving participation in a secondary study, such as a SR, a limited SLR, or a mapping study.

Only three studies have specifically focused on teaching EBSE, as opposed to the SR process, all published by 2008 [Jørgensen et al. 2005, Rainer et al. 2006,

Rainer and Beecham 2008]. Notably, two of these studies describe teaching experiences based on the same modules of empirical evaluation for SE in the UK [Rainer et al. 2006, Rainer and Beecham 2008]. The key details of these studies are as follows:

- Jørgensen et al. report on the experience of teaching a mandatory undergraduate EBSE course in Norway from 2003 to 2005 . Students carried out individual projects that required them to formulate a research question, search for evidence (including scientific sources, expert consultations, and outreach to two companies), and draw conclusions based on the evidence they gathered. The authors observed that *"the best project reports would, according to our assessment, provide good input to real-world SE decisions."* The main challenge was the lack of relevant scientific studies for many of the topics chosen by students.
- In Rainer et al.'s study, students applied EBSE to evaluate a technology of their choice that could potentially solve a specific problem in SE, often related to their final-year projects [Rainer et al. 2006]. Few students employed SRs; instead, many evaluated the technologies themselves rather than seeking supporting evidence. Furthermore, only a small number of students effectively integrated their practical experience with the evidence they reviewed.
- Rainer and Beecham tasked students with using EBSE to evaluate one or more of four specific Requirements Management Tools [Rainer and Beecham 2008]. The tools were based on an evaluation conducted by a commercial organization in collaboration with the authors' university. While students were able to complete the evaluation, they faced significant challenges. Many selected tools based on the availability of online information about the vendor or tool rather than their relevance or suitability. Additionally, many students recommended the tool they initially chose, with some indicating that their recommendation was driven by adherence to guidelines rather than the actual evidence they analyzed.

In summary, the integration of EBSE training with professional practice has been explored only to a limited extent, and in all cases, it required students to engage in activities covering all five steps of EBSE. Moreover, previous initiatives suggest that incorporating practical elements into EBSE training presents significant challenges, often due to limitations in the availability and quality of SE evidence.

3. EBSE Training Module for University Students

In 2017, we introduced an elective course on EBSE & SRs into the five-year Computer Science degree program at Universidad de la República. Students, who typically take it in their fourth or fifth year, must first complete the mandatory SE course. The course aimed to teach practical EBSE concepts and techniques. By the end, students were expected to understand the basics of EBSE, identify SE issues that could be addressed by evidence, assess published secondary studies, and participate in SRs.

Learning outcomes (LOs) guided the course design and assessment, specifying what students should achieve [Kennedy et al. 2007]. The course grounded over fifty LOs to promote practical EBSE application [Pizard et al. 2021], covering topics such as: (i) Basics of scientific publications and SE research methods; (ii) Introduction to the EBP and SR characteristics, based on key chapters of the EBSE reference book [Kitchenham et al. 2015]: (iii) The SR process and its stages.

The course alternated between theory and practice, with weekly meeting to monitor students' progress on their team assignments (conducting a secondary study). Based on prior EBSE training challenges [Pizard et al. 2021], the teachers focused on: Limiting team assignment workload in certain EBSE stages, assisting students in selecting review topics, and supporting iterations in the team assignment.

The 14-week course included one optional in-person class per week. Table 1 shows the topics and team assignments for each week, with weeks 11-13 dedicated to completing the team assignments.

Table 1. Course timetable, including class topics and student assignments.

Week	Topics	Team assignments
1	Basic aspects of scientific publications, Introduction to SE research, Evidence-based paradigm, SRs in SE	Classify the sections of a scientific paper.
2	Planning an SR	Establish the purpose and the need for the SR to be performed by each team. Propose and validate the research questions.
3	Searching for primary studies	Define the search strategy for the SR. Create and validate the search string.
4	Study selection	Define inclusion and exclusion criteria for the SR. Define and conduct the selection process, obtaining 20-30 primary studies per student.
5	Study quality assessment	Define and conduct the quality assessment procedure for the selected primary studies.
6	Data extraction from the studies	Define an extraction form and use it to extract data from the primary studies.
7	Mapping study analysis	Classify primary studies according to commonly used schemes and schemes relevant to the research questions.
8	Introduction to data synthesis, Qualitative synthesis	Use qualitative synthesis to answer the research questions, considering the limitations of the review process.
9	Reporting a systematic review	Report the results and the whole process.
10	Knowledge translation and diffusion	-
14	Deadline for team assignment submission	

Students worked in teams of two or three to conduct a SR as a course assignment. They selected their SR topic and research questions with teacher guidance to keep the scope manageable. Weekly classes included a brief lecture on an SR stage, followed by team work time. Students applied the concepts from the lecture to their SR, with the final report due in week 14. Pre-reading from the EBSE book (i.e., [Kitchenham et al. 2015]) was required, and weekly tasks focused on completing the SR stage discussed in class.

Following EMSE journal reviewers' suggestions [Pizard et al. 2021], we made changes to the 2021 course to reduce the emphasis on the SR process and better balance it with EBSE concepts. The changes included adding [Kasoju et al. 2013] to the reading list as an example of EBSE in practice, assessing students' understanding of EBSE steps through a written test, and incorporating the final EBSE steps with a focus on contextual information and practical application. In addition, there was an interest in including an activity aimed at preparing students to use evidence to address problems they might encounter in their future professional practice. This interest prompted this study's conduction.

4. Research Goals and Method

We aimed to study the challenges involved in creating scenario-based exercises and their usefulness in improving the teaching of EBSE. Specifically, our research questions were:

RQ1: What challenges should be expected when creating scenario-based exercises to teach the use of evidence in professional SE practice?

RQ2: What are the benefits and challenges of using scenario-based exercises for teaching EBSE?

To address both RQs, we examined (1) how to create a practical scenario for applying evidence and (2) how to use it to improve EBSE teaching in 2021 & 2023 courses.

Our research consisted of a mixed-methods study [Venkatesh et al. 2013]. For the development of the scenario, we employed the participant-observer method [Atkinson and Hammersley 1994], while for the restructuring and delivery of the course, as well as the assessment of the scenario-based exercise within the course, we applied action research [Davison et al. 2004]. Both parts of this study are exploratory.

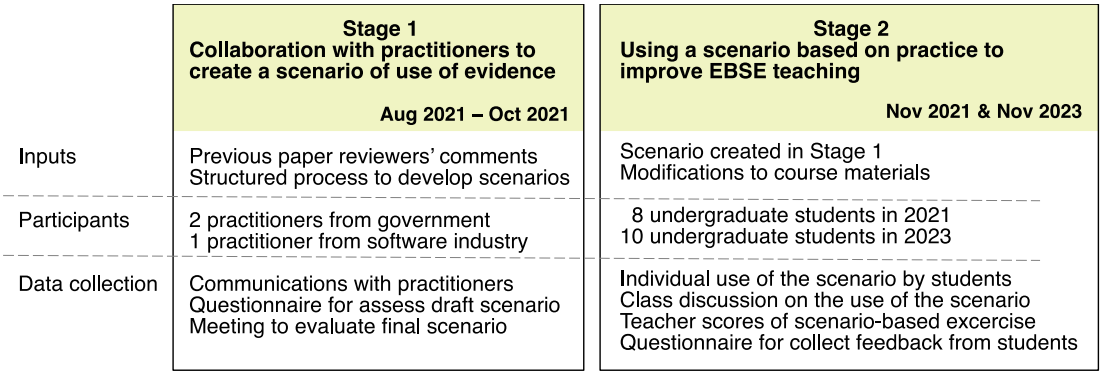

Figure 1. Summary of research stages.

As shown in Figure 1, data was collected in both stages (details will be presented in the next section). The only researcher involved in these stages was Pizard, who was also the course instructor. Several months after the 2021 course concluded, the second author—a former student from the 2021 course—undertook her capstone project, which involved receiving training in qualitative analysis and conducting the analysis of the 2021 data. Pizard then validated and complemented this analysis by including his own analysis of the 2023 data.

Regarding ethical considerations, during the first meeting with both practitioners and students (hereafter referred to as participants), the first author informed them about the EBSE training research, including its goals and data collection procedures. He assured the participants that all information would be kept confidential, participation was voluntary, and for the students, withdrawing from the study would not affect their learning or evaluation. All participants voluntarily and explicitly agreed to participate, and in the case of the students, they also signed informed consent forms.

Qualitative data analysis was strongly based on thematic analysis [Braun and Clarke 2006], including inductive coding, the identification of themes, and the selection of illustrative quotes. OTranscribe[1] and TurboScribe[2] were used to transcribe audio.

[1]https://otranscribe.com/

[2]https://turboscribe.ai/

5. Results

First, we describe the process we followed to develop our scenario-based exercise in the next section, highlighting the challenges we encountered (RQ1). Second, we report how the scenario-based exercise was integrated into the EBSE course and present the results of the evaluations with students from the 2021 and 2023 cohorts (RQ2).

5.1. RQ1 Development of the Scenario

We adapted the process proposed by Manns and Darrah [Manns and Darrah 2012] to create a practice scenario to improve the teaching of EBSE (see Figure 2). Practitioners participated in specific activities based on their availability, rather than throughout the entire process. The activities involved in creating the scenario are summarized below.

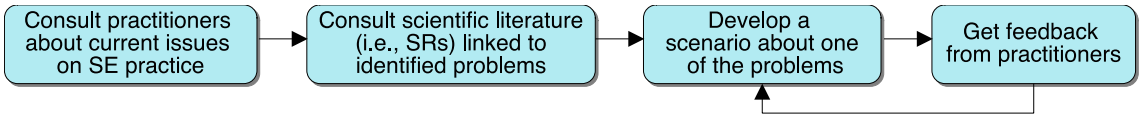

Figure 2. Scenario development process.

Consult practitioners about real problems. The three practitioners who collaborated with Pizard are acquaintances of his. They are all between 40 and 45 years old, with over 15 years of experience, consisting of two women and one man. One works in the private sector, while the other two are in the public sector –one at the government telecommunications company and the other at the Central Bank of Uruguay. Pizard explained the research purpose to them and asked about current open problems in their practice. They responded with a list of 11 issues related to process management, agile development practices, estimation, knowledge management, code quality, requirements analysis, and training (see appendix 7).

Consult scientific literature linked to identified problems. Based on the list of identified problems, Pizard conducted searches in SCOPUS and Google Scholar using terms representative of each problem. No secondary studies with research questions that addressed the identified (or similar) issues were found. Given this, Pizard referred to the study by Budgen et al. [Budgen et al. 2020], which he was already familiar with, and which presents a tertiary review in SE up to 2015. This study identifies and categorizes secondary studies with findings considered relevant for teaching industrial practice in SE. After reviewing the list, two SRs were found that relate to one of the problems identified by the practitioners [Bano and Zowghi 2015, Pacheco and Garcia 2012]. This problem, as expressed by one of the practitioners, is: *"How to prioritize equally among different stakeholder groups so that the client receives what they need as quickly as possible? How to prioritize requirements when dealing with different user groups?"*

Develop a scenario about one of the problems. Based on the identified problem and both SRs, Pizard drafts a scenario for using evidence. The following objectives, aligned with the principles used by Manns and Darrah [Manns and Darrah 2012], were pursued:

- Focus exclusively on interventions, excluding diagnostic aspects to simplify participant involvement.
- Preselect interventions for each scenario to streamline scoring and preparation.
- Avoid differentiating based on the strength of the evidence[3], given the immaturity of SE evidence.
- Given the limited time students have to use the scenario, minimize effort by providing two SRs as the sole sources for completing the assignment.

Gather feedback from practitioners. The draft scenario was shared with the practitioners, who were asked to evaluate whether it resembled real industry problems and if the proposed solutions (based on the SRs found) were appropriate for addressing these issues.

After two iterations to refine the scenario, it received an average rating of 7 out of 10 from the practitioners for its similarity to industry problems, with no major issues identified (scores between 1=Completely unrelated to industry problems; 10=Very similar to industry problems). Regarding the proposed solutions (derived from the SRs) included in the exercise, the practitioners found them somewhat adequate but felt there were other alternatives they would have preferred. When reminded that these proposals were grounded in scientific evidence and could be clarified but not replaced, two practitioners noted that this, along with the fact that SRs were found for only one of their proposed problems, aligned with their views on the gap between academia and industry. They added that academia should take a more proactive role in engaging with industry.

As detailed in the following subsection, the scenario was used in the EBSE courses of 2021 and 2023. At the end of the 2021 course, it was revised to improve its wording. Due to size constraints, we present only its latest version here (refer to Table 2).

5.2. RQ2 Use of Scenario

The scenario-based exercise, along with other improvements, was incorporated into the EBSE & SRs course. Specifically, an extra class was added after week 10 of the course to help students achieve the following these new learning outcomes:

- LO59 – Describe factors that affect the use of evidence: its nature, the context of application, and the facilitation process.
- LO60 – Participate in the analysis of scenarios involving the use of evidence.
- LO61 – Analyze the EBSE process and its improvement.

The dynamics of how students engage with the scenario are as follows. Before the new class, as part of a team practical assignment, students are required to read the scenario and reflect on whether the proposed solutions are appropriate, considering the evidence provided in the recommended SRs. During the first minutes of the class, student teams have the opportunity to ask questions and make any final adjustments to their assignment before submitting their responses.

Next, and after submission, the class engages in a group discussion centered on the scenario exercise. This is followed by a lecture from the instructor addressing the

[3]In this context, the strength of evidence refers to the robustness and reliability of the information collected, including the rigor of the methods used by researchers in each primary study.

Table 2. Exercise for applying evidence based on a real-world scenario.

Below, a professional practice scenario is outlined. The scenario describes a specific context, a problem, and two proposals for addressing it. You are asked to evaluate whether the proposals seem appropriate, using what you have learned in the course (scientific evidence, systematic reviews, etc.). To do this, it may be necessary to assess whether the proposals are supported by scientific evidence; if so, you may use the two reviews mentioned. If you use other materials, please indicate which ones. Recommendations: • Remember the definition and steps of EBSE. • It is likely unnecessary to start with a complete reading of both SRs. • Consider the factors that affect the use of evidence [Kitson et al. 1998]: the nature of the evidence, the context of use, and the method or way in which the process of use is facilitated. • During the next class, each group will have few minutes to ask questions, after which they will submit their response with a maximum of 200 words.
You are part of a project team that will develop a system for requesting and delivering per diems to be used in various ministries and government agencies. A per diem is the money provided to employees for travel, food, and lodging expenses incurred while performing their duties away from their usual place of residence. Your team is responsible for requirements gathering and software development. To this end, you plan to use an agile methodology due to your considerable experience. For the project's success, identifying stakeholders and their involvement is deemed crucial. This is quite challenging because there are many stakeholders from different organizations and agencies, with varying needs that are currently unclear. Your team has proposed: • Identifying all stakeholders and conducting personality tests to those who will participate in the requirements gathering to assign them the most suitable roles, and • Promoting constructive interaction among all stakeholders during the requirements gathering, e.g., by determining each stakeholder's actual interests and establishing appropriate communication channels. Materials that can be used: [Bano and Zowghi 2015, Pacheco and Garcia 2012]

complexity of using evidence in practice and the factors that influence it (LO59, see [Kitson et al. 1998]). The session concludes with a discussion on the objective of step 5 of the EBSE process (i.e., analyzing and improving the EBSE process) and how students believe this goal can be effectively achieved (LO61).

To evaluate the use of the scenario (i.e., evaluate LO60), questions were distributed that students had to answer individually and in teams during the final class of the course. In addition, we analyzed the teachers' assessments of the practical work on the evidence scenario, along with the video recordings of the open-class discussions. Figure 3 summarizes all these activities.

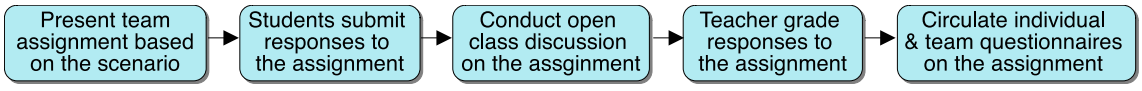

Figure 3. Activities conducted to assess the scenario in the EBSE & SRs course.

The evaluation was conducted during 2021 and 2023, in courses attended by 8 and 10 undergraduate students, respectively. Figure 4 presents their demographic data, gathered at the end-of-course individual questionnaire. All students have industry experience, with the majority having held technical roles. Most students work part-time or full-time during their final two years, as our university is public and tuition-free and there is high demand for IT professionals.

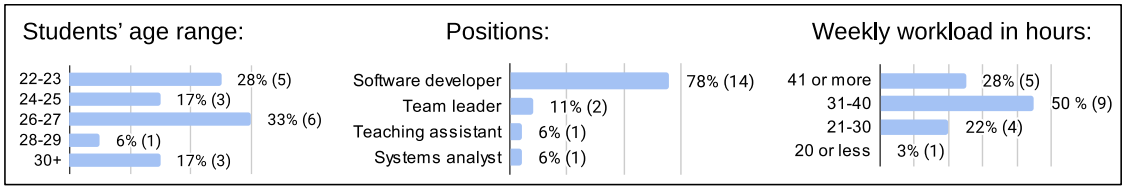

Figure 4. Students demographics.

Achievement of Learning Outcomes. Figure 5 summarizes the assessment of the LO related to the use of evidence in a practical scenario by the students. This includes both the students' opinions and the scores assigned by the teacher on the practical assignments.

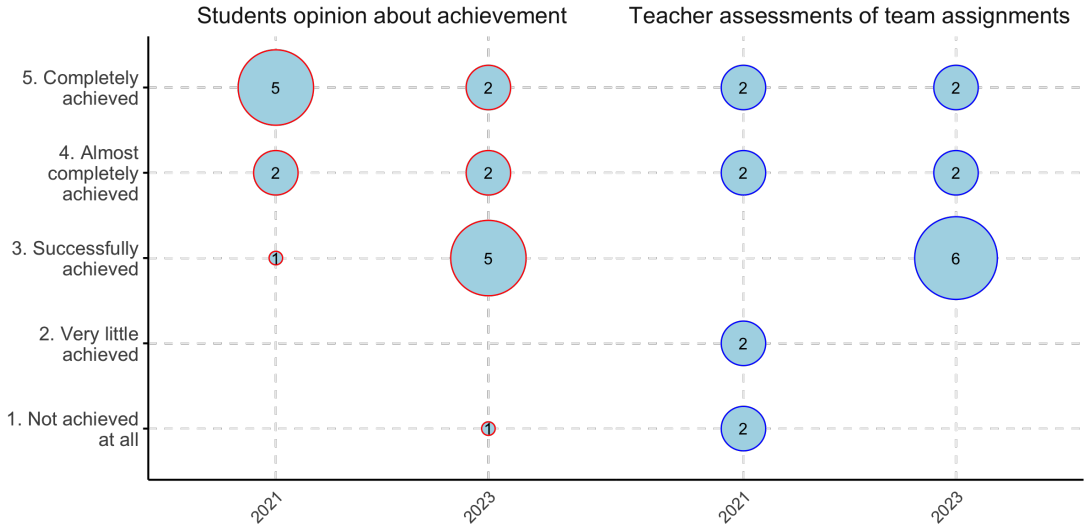

Figure 5. Students' Achievement of LO60.

In 2021, half of the students (4 out of 8) struggled to complete the exercise satisfactorily, as they reported not fully understanding what was required. However, through class discussions and reviewing their submitted responses, they improved their understanding of how to use evidence. This progress was reflected in their feedback on the achievement of LO60 at the end of the course. By 2023, the exercise instructions were revised to make the requirements clearer, which appears to have contributed to better student performance.

Benefits of Using the Scenario. More than half of the students (10 out of 18) reported that the exercise helped them gain a better understanding of the entire EBSE process, particularly the use of evidence in practice. One student remarked: *"It is an exercise that reflects the entire process we progressively followed throughout the course. It helps to understand the importance of synthesizing information and applying it to a concrete case."* Another student highlighted that using evidence to address the practical scenario helped them better recognize the value of aggregating evidence.

It is also worth noting that incorporating this scenario-based exercise did not significantly impact the students' performance or their perceptions of achieving the other

learning outcomes of the course.

Challenges of Using the Scenario. Using a practical scenario to enhance the teaching of evidence-based practice presented three major challenges.

Almost half of the students (8 out of 18) highlighted the difficulty in evaluating and applying evidence. For instance, they noted that the challenge stemmed from the SRs referencing one of the recommendations proposed in the exercise and citing support from several primary studies, yet they found this evidence insufficient. One student remarked, *"There is evidence, but I'm not sure if it can be considered enough."* Another student mentioned being unsure how to compare the contexts of the SRs with the scenario, while other found the problem overly complex and the proposed solutions too simplistic.

Issues with using SE SRs. Nearly one-third of the students (5 out of 18) reported difficulties in understanding the SRs. Additionally, 3 students mentioned that the SRs did not provide actionable recommendations. We believe that both challenges also contributed to the previously mentioned difficulty in applying evidence.

Finally, 6 out of 8 students in the 2021 course indicated that they struggled to understand the exercise instructions. Similarly, 5 out of 10 students in the 2023 course also reported initial difficulties with the instructions.

5.3. Discussion of Findings

Several aspects of our results deserve reflection and analysis.

Creating scenario-based exercises for applying scientific evidence. Creating scenario-based exercises for applying scientific evidence can follow Manns and Darrah's process [Manns and Darrah 2012], but it needs adaptation to fit the nuances of SE. We recommend:

- Exploring ways to collaborate with practitioners while accommodating their skills and limited availability. In our case, this approach meant that practitioners, for example, did not engage in reading, searching for, or selecting scientific papers.
- Considering the limitations of SE evidence. We found SR evidence only for one of the eleven topics raised by practitioners. Although our searches were not exhaustive, this appears to align with other studies that discuss the limitations of SE evidence (e.g., [Jørgensen et al. 2005, Budgen et al. 2020]). This could be mitigated by consulting SR catalogs, but none exist formally in our field. We used the list of SRs reported by [Budgen et al. 2020]. Currently, the SR list published by [Kamei et al. 2021, Kamei et al. 2022] is also available.

After evaluating students' practice of the learning outcomes, we concluded that LO60 should use the verb *evaluate* instead of *analyze* to better reflect its complexity according to Bloom's taxonomy [Bloom 1956]. This adjustment is justified because students are required to focus on evaluating both the evidence and the context in which it is to be applied.

Usefulness of scenarios for teaching the use of evidence in practice. Students reported that the exercise helped them better understand how to apply scientific evidence in practice. Additionally, we believe it introduces them to the complexity of using evidence and encourages critical thinking on this subject.

Scenarios help clarify what is expected from students when applying evidence in practice, reducing issues noted in previous studies, such as selecting overly familiar or overly documented topics [Rainer et al. 2006, Rainer and Beecham 2008]. That said, instructions must be clear, and guidance should be carefully crafted to be as unambiguous as possible. An open discussion session on the use of evidence in the proposed scenario, held after students submit their responses, appears very useful for promoting reflection and consolidating learning.

In a recent paper, Wilson et al. reflect on a fundamental challenge in SE: *"how to get researchers to focus on problems that practitioners care about and practitioners to pay attention to what researchers discover"* [Wilson et al. 2024]. They suggest that the best opportunity to bridge this gap is during undergraduate education, when future researchers and practitioners are still fully engaged. They argue that if students graduate without exposure to research methods and relevant research insights, they are unlikely to seek out researchers or academic literature for support or solutions later in their careers.

We agree with Wilson et al.'s argument and believe that teaching EBSE effectively exposes future practitioners to scientific evidence. In a study on the effects of EBSE training among our former students, it was found that although no student had conducted an SR, over half of the respondents reported improvements in their work practices, particularly in their information literacy skills and confidence in using scientific evidence [Pizard et al. 2022].

Our proposal, including scenario-based practice to solve real-world problems, brings students closer to both research methods and scientific findings. This approach prepares them to incorporate evidence into their practice, a complex but essential skill.

5.4. Limitations of this study

Many of the limitations related to our EBSE training also apply here [Pizard et al. 2021]. (1) Volunteer participants may be motivated to support the study's objectives. (2) The course was optional, so it might have only attracted students interested in SE and EBSE. (3) The practical work focused on SR process possibly leading to better preparation for aggregating studies than for identifying issues that EBSE could address. (4) Learning assessments might have included teacher bias, which was minimized by using predefined grading criteria. (5) Activities and resources, like slides and an introductory EBSE report, were included in Spanish to reduce comprehension issues because some course materials were not in the students' native language.

Additional limitations of this particular study are: (6) The context of the scenario was a company that provides software for government agencies, which might be unfamiliar to students. To minimize this, the context was explained to students and some specific comments were made about general characteristics of SE in government agencies. (7) As a field study, results may be context-dependent, not generalizable, with potential low control over events and measurement precision [Stol and Fitzgerald 2018]. (8) Practitioners involved in scenario development were acquainted with Pizard possibly influencing their

responses. To mitigate this, they were repeatedly reminded that honesty was paramount when providing feedback, and that both positive and negative comments were equally important. (9) The 2021 and 2023 courses had the first author as the sole instructor.

6. Concluding remarks

Using a scenario-based exercise to teach the application of scientific evidence in practice appears effective in helping students grasp the EBSE process at a more abstract level and its use to improve SE practice. For example, it allows them to better understand how evidence is aggregated and to apply what they have learned throughout the course to tackle a practical problem. Developing scenarios highlights the gap between industry and academia and shows how difficult it is to find SRs that address real-world problems, partly due to their scarcity and the lack of catalogs to easily locate them.

For future work, we plan to bring EBSE teaching even closer to practice. Specifically, our goal is to develop and offer EBSE training for industry practitioners and government agency members. Additionally, it also seems interesting to continue developing different scenarios to teach the use of evidence, in order to have more teaching material.

Artifact Availability

Data from the first stage are unavailable due to non-disclosure agreements, while second-stage data are accessible at [Pizard and Marenco 2025] (In Spanish).

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7. Appendix: problems identified by the practitioners (refer to section 5.1).

The following is the complete list of current practice problems identified by practitioners in Stage 2 of this study. This is an English translation of the original Spanish concerns expressed by the practitioners, although every effort was made to preserve their exact words and intentions.

1. How to ensure that the client understands how agile methodologies work? Generally, clients want fixed deadlines, fixed scope, everything delivered as quickly as possible, and often apply pressure.
2. Estimations are challenging; we use expert judgment, but clients increasingly want everything faster. They send a brief description and expect a quick and accurate estimate. How to improve estimation?
3. Managing a very large system over many years is difficult. Design ideas or specific functionalities might be used occasionally, but over time, it's easy to lose track of how they work or the correct way to implement and integrate them. How can we preserve the knowledge of processes, especially in massive applications with high team turnover? Documentation exists, but even remembering where things are documented can be a challenge.
4. Control code quality. Is very difficult to... the code reviews. At some point, you have to trust that developers are doing things correctly because reviewing every line is complex. Even though automatic analysis tools are used, they don't catch everything... and some issues slip through. How to control code quality?
5. How to balance quality with deadlines? Stress, and the pressure of arbitrary timelines can be tough. The theory is great, but in practice, it becomes very complicated.
6. How to identify the Minimum Viable Product (MVP) that adds value to the customer?
7. How to estimate when you depend on other development groups?
8. How to prioritize equally among different stakeholder groups so that the client receives what they need as quickly as possible. How to prioritize requirements when dealing with different user groups?
9. Having a fixed team with a high workload is challenging. It's hard to balance daily (urgent) tasks with research (important) tasks to make progress and incorporate, for example, new technology. How would you create a process that allows these two aspects to work together? Hiring more people isn't always an option, and when new hires finally gain the necessary expertise, they might leave (high turnover). How can we balance innovation management with development and maintenance?
10. We have many legacy systems. When considering a rebuild, the business usually asks for the new system to *"do the same as the previous one"*. It's tough to get the business to generate new requirements during the migration of legacy systems. If the initiative doesn't come from IT, business involvement isn't as strong. It's hard to get the client to see this as a new opportunity to rethink things. How to involve the business in the rebuilding of legacy systems?
11. How to introduce agile for the first time in an overstructured organization?