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On the benefits of using learning journal assignments in technical undergraduate courses

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Abstract

In higher education, undergraduate technical courses tend to focus mainly on the technical content and use assessment tools to measure how well the students do with the technical knowledge/skills. In addition, students' evaluations of instructors and courses happen at the end of a semester, which provides some valuable feedback to the instructors to apply in their next offerings. However, these are too late for the current offering. This leads to two problems: First, the students know that they will not benefit from the evaluations and tend to offer little feedback and second, the instructors do not have a clue about how their students are feeling about the course and whether they have issues. Therefore, we introduced a new assignment geared to encourage students to continuously interact with the material and to provide the instructors with continuous feedback from the students throughout the semester. We added a learning journal assignment requiring students to answer specific prompts about their learning, interests, issues and feedback every week. It is a graded low-stake assignment thus students can complete it without fear of negatively affecting their grades. Over several applications of this assignment in different engineering and computing courses we found the following: (1) Students' interest in the courses' sessions and content has increased; (2) Students became more open and were able to express their needs more easily in the privacy of the journal entries; (3) Instructors were able to catch learning problems early and address them in class in real-time; (4) Students' evaluations of these courses at the end of the semester improved significantly. For the students, this has become a way to reinforce their learning and help them review and reflect on the material being studied. As instructors we see this method as a valuable and interactive feedback mechanism that helps us improve our teaching, address problems quickly, and adjust to specific students' needs on a continuous basis.

Keywords: Learning journal, student evaluation, teaching methods, assessment instruments, reflection, technical courses.

Introduction

Conventionally journaling was considered a personal and leisure type activity. However, using journals in education has become an effective tool to help students assimilate content and reinforce learning (Hiemstra, 2001), (Loeffler, 2019), (Van Walraven, 2017) and (Varner, 2003). However, this approach is more common in literature and humanity courses such as geography (Park, 2003). Some recent work showed its use in business such as marketing (Berezan, et. al., 2023). Yet, it is seldom used in technical courses like engineering and computing. The closest use of learning journals to technology and engineering courses we have come across is in biology (Sadikin, 2018) and natural sciences (Zulfah, 2018). Various researchers and academics discussed the benefits of using learning journals for students' assessment such as in (O'Rourke 1998). In addition, some discussed how journaling can be helpful in self-regulation learning

(Nückles, et. al., 2020). The literature also provides some insight on different journaling techniques such as those discussed in (Baleghizadeh, 2014). Furthermore, some work investigating the long-term benefits of reflective journaling is highlighted in (Alt, et. al., 2022) where the authors show that learning journaling skills in college will help with their lifelong learning. In (Stevens & Cooper, 2023), the authors provide some ideas on how to use journaling for teaching and learning.

On the other hand, traditionally, as instructors, we have to wait until the semester ends to get the results of the students' course/instructor evaluation feedback about the courses that already ended. For a long time, we relied on this feedback to adjust and improve our courses in future offerings. Yet, this feedback is usually minimal and very few students offer good information to help us. We believe this is mainly because they feel that the results of the feedback will not apply to them, or they do not have enough motivation to do it. At some point we felt that this feedback is not enough and that we needed a better way to engage the students and motivate them to give more and better feedback.

Thus, we started with the question whether using learning journals in technical courses could help the students and instructors achieve some of these benefits. Thus, we started our experimental use of the learning journal assignment in some of our engineering and technical courses. The assignment required students to write their entries based on specific prompts. It is generally common that students will not complete course work unless they get some credit for it. Yet, including it in grading may scare the students and they will not provide good feedback. Thus, we made sure that we avoided both problems by putting a small percentage of the grade on the assignment and informing the students that the grading is based only on on-time submission and coverage of all prompts regardless of what they say. One of the things we found we had to do is keep reminding them of this arrangement so they will feel confident and become more open about their issues. The results obtained through the use of this assignment in several courses confirm that there are several benefits for both the students and instructors. In general, the outcomes of this assignment have become increasingly valuable to us as we strive to improve our courses and provide better and more realistic learning experiences for the students.

This paper explains how we used learning journals and the results we reached. In the next section we describe the assignment details and how it was applied in our courses. The following section outlines the outcomes of using the learning journals and how they impacted both students and instructors. Then we discuss these outcomes and the challenges and issues we need to deal with as we use this assignment. Finally, we conclude the paper with a summary of the findings and a brief overview of future steps.

Methodology

When we decided to use this approach, we added a "Learning Journal" assignment to some of our technical courses. These included courses such as data structures and algorithms, software design and construction, and simulation. Initially, we required one entry every 4-5 weeks to see if the assignment would work and to refine the prompts. Eventually we progressed to making it a weekly assignment after we saw the positive impact of the first few applications.

This assignment is designed to have the students practice journaling while keeping track of their learning in the course. It requires them to write a journal entry reflecting on their learning at the end of each week of classes. We continuously encourage them to be honest and open and always emphasize that the content (positive or negative) of the entries will not affect their grades as long as they complete the required components. After the students submit their entries, we read and comment on them to give the students

some feedback. We also take note of important issues that come up and discuss them with the students either individually (in private) or in class if it concerns a large number of students in the class.

Each entry for a given week is due on Monday the following week. This allows the students enough time to review the material, reflect on their learning and write the journal entry. Although we believe that the best outcomes of this type of assignment can be achieved if the students perform the review and reflect on the material immediately after each class. However, we know that some students may have other work to do during the week and thus we included the weekend so they will have enough time to complete and submit their entries. Each week the students will write an entry that includes, at the minimum, responses to the following prompts:

1. A summary of the topics covered during the week
2. What they learned from the material during the week
3. What they are curious or want to learn more about
4. What their favorite/exciting thing about the class/concepts was
5. What the difficult, boring, annoying, or demanding thing(s) were
6. Suggestions to improve the week's experience/topics/activities
7. Any other relevant reflections and concerns (optional)

The first point is designed to somewhat force the students to review the material covered and create a summary of the topics. The second point is where they will start reflecting on the material and identifying what they learned from it. These two points act as a study tool that helps the student focus their thoughts and keep track of what they learned. The third point allows us to see what else the students are thinking about when we discuss a topic. This gives them a chance to tell us what is interesting to them among the topics discussed. Points 4 and 5 allow them to talk about things they liked/disliked in the class like tests, activities, specific topics, etc. Answering these two prompts will help the students identify their interests and let the instructor know about them. Then we give them a chance to voice their views and suggest ways to make things more interesting to them. Additional comments are always encouraged through the last point.

Each week after the students submit their entries, we read through them to determine how the students are doing and respond to their comments. In general, our actions follow one of the three directions:

1. Write direct (private) comments to a student answering their questions, explaining some concept, or providing additional material about some topics. These comments could also be some advice on how to study, how to manage their time and course load, or how to deal with difficult topics. This is a quick way to address comments and let the students know that we hear them and answer their questions.
2. Ask the student to meet with us (after class or during office hours) to discuss bigger issues. In some cases, we find some students who are struggling and need more help or the questions they raise need some discussion, and this is when we use this option.
3. Address the comments in class when it concerns several or all of the students. This happens when we find similar comments or questions across multiple entries from different students. Actions in this case include explaining some difficult concepts, adding more hands-on activities to reinforce a certain topic, adjusting some assigned work, even introducing a new relevant topic of interest that was not originally in the course topics.

The scoring for this assignment is usually given around 10% of the course's total score. This number is significant enough to get the students to do the work (considering that it is a weekly assignment), but small enough not to be a major concern. The individual scores are assigned as follows:

1. 100% if an entry is submitted on time and all the required prompts were covered adequately. We usually do not use the actual content to assign the grade.
2. 10% loss of the score of an entry for each day it is late up to 50% total loss.
3. 50% of the entry's score if it is more than 5 days late no matter when it is submitted during the semester.

There are usually more required entries than those that will count towards their total score. For example, we assign 100 points where each entry gets 10 points. Then we require 12 entries adding up to 120 points that we roll over into the student's total score. This arrangement means that a student who misses a couple of entries or is late for a few entries may actually be able to get a high total score. In addition, this gives us the chance to continue to encourage them to submit entries even if they were very late.

Outcomes

We found that the students' entries offer a good source of information about their individual capabilities and their perception and satisfaction of the course and instructor. We found that many of the entries offer us a good insight into their thinking and learning process so we could adjust our teaching/learning methods in real-time. In addition, we saw that the overall course/instructor evaluations result for the courses where this assignment is used has improved compared to earlier evaluations when we did not use it.

Based on the responses from the students to the prompts described earlier, we can address issues and make changes in real-time. Points 1 and 2 are the basic measure of how the students are doing and the responses allow us to see what each student understands and what they think they learned. One of the main benefits here is seeing if we need to adjust our expectations of the students learning or the ways we teach the content.

Point 3 provides an interesting perspective about what the students see as important or of value to them. Some students ask about specialized topics relevant to the week's content and we respond by giving a brief explanation and links to suitable resources in the private comments to the student. In many cases we get comments asking about specific concepts or keywords that we brushed on in class. Curiously enough, it happens a lot that several students will point out very similar topics. In various occasions, we would bring the topic up in class and cover it briefly then point the students to some good resources about it. In other cases, if the topic is highly relevant and we have time we may dedicate a full session for this topic later in the semester. A nice benefit for us here is that we get to explore topics that we did not think would be relevant and, in some cases, adjust course content for future offerings to include them. Sometimes, this allows us to advise students to take specific courses that may interest them based on their input.

The most important parts for us as instructors are points 4 through 6. The students' answers to point 4 allow us to see what they are excited about and what they liked. This gives us confirmation that these parts are good and we need to do more like them. When students say that a certain activity helped them understand a certain topic better, we consider how we can use a similar activity for another topic. In some cases, we introduce a new activity or method and we are not sure how well it will go. When they tell us that they liked it and it helped, we can then confirm that it works and should remain. In the following point the students tell us what they did not like or had issues with. In various occasions we get comments about some of the difficult topics and how they are not sure if they understand them. In this case, if the issue appears for one

student, we can write detailed explanations and include links to suitable resources to help the student learn the concept. If the problem occurs for several students, then we plan sometime in the upcoming classes to revisit the concept and address the difficult points in class. There were a few occasions when we rearranged some topics to create a better organization that can help address these difficulties in better ways.

The sixth point is an open request for suggestions that allows the students to feel in control and use their creativity to come up with ideas for us to do for the class. Unfortunately, this part gets the least input from the students. However, the few suggestions we get are usually very good ones. There were some cases where a student would say that a certain topic did not get enough coverage and when we examine it, we find that we sometimes agree and make the adjustments accordingly. There were a few cases that actually led us to rearrange a number of topics for better flow, add/switch content, or remove some content based on students' suggestions. Several add suggestions for different activities or assignments. The last point is usually never covered especially that the students see that it is an optional point. However, we continue to include this point to give the students that extra bit of freedom to express themselves beyond the required prompts and we always hope for additional input.

Discussion

Adding the learning journal assignment in several of our engineering and computing classes led to significant improvements in these courses, better learning opportunities for the students, and better course evaluation results for us as instructors. We worked on keeping up with the students' journal entries and addressing their input. The real-time actions taken based on the students' entries showed the students that:

1. We do care about them and their learning
2. We listen to them and work on addressing their comments and concerns
3. We are willing to change our ways to meet their learning needs.

The journal entries gave the students a private and less intimidating method to tell us what they think. It was hard to get the students to ask questions or provide comments openly in the classroom. It was also just as hard to get them to come see us during office hours to address their issues. When they started journaling, they realized that they could contribute, ask questions and provide suggestions without feeling awkward or intimidated. As a result, we were able to know about and address their problems and help them recover quickly.

We found that addressing comments in points 4, 5 and 6 are the most valuable. We learned so much from these points in the journal entries for various courses. Overall, we were able to adapt our methods and improve our teaching and material to meet the students needs. For example, when several students identify a certain concept as difficult, we bring the concept up in class again and use different ways to re-explain it. Also, when several students express strong interest in some concept, we try to make some time to explore it further or provide the students with pointers and references about it to check out on their own. In addition, when students give suggestions for improvements, we take them seriously, evaluate them and try to apply them when appropriate.

In one of the courses, for example, we cover different types of sorting algorithms, and many students find it hard to analyze and compare the algorithms' performance. As a result, we introduced some activities in class where they use playing cards to apply different sorting algorithms physically and see the actual changes and movements of data. In addition, we added a competitive element where students will compete in sorting cards using their assigned algorithm and we find out the fastest. The feedback after introducing

this type of activity was positive and many students reported learning more this way. In another course a student suggested that we give the students more opportunities to research and explain new concepts and we created some activities where students will work in groups to research an assigned topic and explain it to the class.

On some occasions, students would venture beyond the course content and discuss other issues related to how they manage their time, other courses' demands, and even personal issues that affect how they do in class. As instructors, we don't usually have direct answers for such comments, but we use it to understand the students and it helps us see what they are struggling with. In many cases we would provide some advice for the students about skills like time management, study techniques, mindfulness and methods to increase focus. In other cases, we may be able to point them to other entities at the university that may be able to help them better and support them with the right tools and accommodation. Some instructors may feel that this is beyond their responsibilities, however, we believe that even though we may not solve their problems, we get to know them better and appreciate what they are going through. At the same time, the students will feel that they can talk to us and tell us about these issues, which increases their trust and consequently makes them more interested in learning in our classes.

Despite the usefulness of the learning journal assignment, there are some issues and challenges. The biggest challenge is for the instructor to find enough time to review and respond to the entries in a good time to ensure achieving the intended good results. It is not easy to read and respond to many entries (these could go up to 50 depending on class sizes) each week. We consider ourselves lucky being in institutions where class sizes are still kept at low numbers (between 10 and 30 usually), which is helpful for this type of assignment. Sometimes, when pressed for time we review entries every other week, which provides fast enough responses, but is not always the best choice.

Another challenge is getting the students to appreciate this assignment and provide appropriate and useful responses. One of the reasons is that some students did not know how to do this appropriately, others said that journaling is difficult for them, and some considered it an unnecessary chore (busy work as some called it). There is also the fact that many write in severe brevity, while others will just put in everything they have in the entry. The brief ones are easy to go through and grade, but do not tell us much about the student, while the detailed ones give the impression that the student just copied the content and did not really interact with the material they are writing about.

It was necessary to constantly remind the students about these issues and guide them to create more effective journal entries. One thing we usually do is provide detailed comments on the entries with regard to content, style, topics to be included, even formatting. This shows each student what our expectations are and helps them improve the following entries. Unfortunately, this type of feedback is time consuming, so we tend to be detailed in the first couple of entries to give them our expectations and help them do better and scale back after that unless there is a need to elaborate later.

We are also considering providing the students with sample entries from earlier classes to show them what we expect to get and help them see how much details and information we are expecting. However, this could also become restrictive to their creativity if they feel that they need to conform with these examples all the time.

Overall, we found that this assignment has more benefits despite its difficulty and demand on both the students and instructors. We made it a required assignment with around 10 percent weight in their total course scores. At the same time, the students knew that grading is based only on covering all the prompts and submitting entries on time. We encouraged them to be honest and rewarded that by addressing the

issues they raise quickly. One recommendation we made for the students early in the semester is to try and make a habit of journaling by putting it on their schedules at a specific time each week and trying to maintain it throughout the semester.

The results gathered from applying this technique in multiple courses over multiple semesters show great benefits and despite its demand on us as instructors, we feel that the benefits outweigh the demand. The students input encouraged us to do better and gave us a way to identify issues and address them. As a result, some of the students' performance improved, interest in being in class also became higher, and many students expressed appreciation for addressing their issues (privately or in class). Another positive effect appeared later when the university wide students' evaluation of the courses and instructors came. Overall, the evaluation results were better and there were more comments and feedback in these forms, which is the most helpful part of these evaluations.

Conclusion

In this paper we attempted to answer the question whether using learning journals in technical courses could be beneficial. We discussed our work on using a learning journal assignment in some of our technical engineering and computing courses. The benefits of journaling have been shown in various fields and there is a strong move to use it in academia. However, it is mostly used in writing/literature and humanities courses. We introduced the learning journals in our courses to help the students interact better with the learning process and provide feedback and comments for us to help improve their learning experiences. We used the assignment in multiple courses over several semesters and the results were very promising.

Despite the high demand on the instructors to read and respond to many entries every week, we believe the outcomes are significant enough to encourage us to continue to use it. The students got a private and unthreatening platform to voice their thoughts and we got significant feedback that allowed us to improve the overall teaching/learning experience for the students. On top of that, we found that our course evaluation results were better and had more comments and feedback, which is the most helpful part of these evaluations. We believe that this assignment had a significant impact on our students and courses and allowed us to make changes and improvements that suit the students during the semester, not after it. We gave the students a voice and we listened.

Despite the challenges, this is a useful and effective assignment for technical (practically all) courses. We tried to address some of the challenges and plan to work on devising techniques to address them more effectively. For example, we are working on creating sample entries and templates for the students so they can use them as guides when they write their entries. In addition, we plan to recruit more instructors to use this assignment and gather more data about the collective effects. Overall, despite the challenges and extra work, we strongly recommend using this or similar assignments in any course. The benefits gained are numerous and easily justify the extra work we have to do.

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