

Flipped peer observation using COPUS for young faculty development

Caterina Bassi¹ , Domenico Brunetto¹ , Helena Dell'Anna¹, Ana Moura Santos² 

¹Department of Mathematics, Politecnico di Milano, Italy. ²Department of Mathematics, Instituto Superior Técnico, University of Lisbon, Portugal.

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Abstract

The present paper aims at contributing to improve young STEM faculty members' training, by focusing on exploring the potential of peer observation in fostering reflection on teaching practices. To this end, two young faculty members were involved as observers of the lessons of a more experienced teacher, using a specific observation protocol, that is COPUS model. The collected data from comments provided during observations, the observers' feedback on their experience in the observer's role and final interviews which focused on the role of peer observation in faculty development are holistically analyzed. The obtained results show that peer observations using COPUS, combined with well-structured feedback sessions and interviews, encourage young faculty members to deeply reflect on their past and future teaching practices and, hopefully, enhance their teaching practice.

Keywords: *Peer observations; COPUS protocol; Higher STEM education; Early-career faculty training*

1. Introduction

Faculty training plays a crucial role in creating opportunities to develop teaching skills (Gunersel & Etienne, 2014). However, as noted by Wimberg et al. (2018), research on professional development in teaching STEM courses at the university remains limited. One potential approach to faculty training is through peer observation, given its potential for fostering reflective processes. Gosling (2002) outlines three models for peer observation, the evaluative model, the developmental model, and the peer-review model, which all involve faculty members being observed while teaching by a colleague. In the first two models, the role of the observer is covered by an expert, focusing, respectively, on the identification of areas of underperformance and on fostering personal growth. The peer-review model takes a more collaborative approach meant to initiate open discussions about teaching practices. For instance,

using the protocol of peer review developed by Dillon et al. (2019), all faculty members involved in the study emphasized the value of observation for reflecting on their own teaching. Also, Sundset and Sandvoll (2022) adopt the peer-review model in their qualitative case study aimed in a multidisciplinary faculty with STEM and business education, highlighting how peer observation enhanced the educational discourse between participants.

Considering the social learning theory (Bandura and Walters, 1977), our primary goal is to explore the potential of peer observation for young faculty members' development, through reflection on teaching practices. To this end, we adopt a slightly different approach with respect to the models discussed previously, introducing what we call a "flipped" peer observation model. Rather than an expert observing a less experienced colleague, this model involves early-career STEM faculty members (young faculty) observing the teaching practices of more experienced colleagues, using an observation protocol. In the present paper we adopt the wide definition of teachers' practice proposed by Da Ponte and Chapman (2006) as the professional tasks that teachers undertake in their instructional roles. We also include the choice of lesson format, the use and types of questioning employed by the teacher (Dougherty, 1990), the management of class discussions and the recognition of patterns of interactions (Wood, 1996).

According to a field study, among the observation protocols designed for large STEM classes, the Classroom Observation Protocol for Undergraduate STEM (COPUS), proposed by Smith et al. (2013), stands out for its widespread use, as highlighted by Anwar and Meneske (2020). In fact, thanks to the simplicity of its coding system, COPUS allows it to be reliably used by faculty members after only 1.5 hours of training, making it accessible even to those without expertise in educational research. COPUS captures classroom behaviors in two-minute intervals throughout a session and avoids requiring observers to make judgments about the quality of teaching. With its 25 distinct codes divided into two categories "What the students are doing" (13 codes) and "What the instructor is doing" (12 codes), COPUS offers a straightforward and practical approach to documenting classroom interactions. For students, examples of COPUS codes include "listening to the instructor" (**L**) and "discussing clicker questions" (**CG**). While instructor codes include "moving/guiding" (**MG**, identifying the instructor moving among students providing suggestions during the group work) and "conducting a demo" (**D/V**, identifying the instructor showing applets, videos, etc.). Despite not being a required step in the protocol, COPUS also allows observers to add comments during observations. Comments may relate directly to COPUS codes, providing explanations and additional contextual details, or may capture broader observations about classroom dynamics and teacher practices.

The present work aims at answering the following research question: how the flipped peer observation model, implemented with the COPUS protocol, can support the reflection of early-career STEM faculty members on teaching practices? The paper outlines the data collection and analysis in Section 2, presents results in Section 3, and discusses findings in Section 4.

2. Methodology

The collected data come from activities that involve all the authors with different roles: two of them (named as Observers A and B) are the participants of the study, while the other two (named as Researchers A and B) employed the analysis of the narratives produced by the participants. This distinction between the participants and the researchers implies that the present work is not a self-study (Bullough & Pinnegar, 2001). However, the participants contribute actively to the conceptualization of the problem and to the discussion of the results.

Observer A, who started her PhD on November 2024, has a very short teaching experience in higher education, namely she was in charge of a small class of the preparatory courses on Maths, edition 2024, aimed for undergraduates in Politecnico di Milano (PoliMi, <https://www.polimi.it>). While, Observer B has eight-year experience of teaching on different mathematical subjects, firstly still as a PhD student, then as a teaching assistant, in charge of large classes of students enrolled in preparatory courses on Maths, for the last five years.

For the present study, Observers A and B applied the COPUS protocol four times, during the fall semester 2024/25, attending Researcher A's course on Elementary Mathematics aimed for a group of Architecture undergraduates in PoliMi, with an average attendance of 100 students. The syllabus of the course covers the basics of Linear Algebra and Calculus with one variable. In general, each lesson lasts for three hours with a break of 15 minutes, after 90 minutes. During the peer observations, Observers A and B, previously trained to apply the COPUS protocol, were seated behind the class so that the data collection process was not too disruptive. In periods of observation that lasted up to 72 minutes, the two observers marked the COPUS codes corresponding to the activities occurring at that moment. They also included many comments on their COPUS coding forms. These peer observations took place at the beginning of the semester, and then at mid-November and mid-December. After the first two observations and at the end of the semester, the observers were invited to give structured feedback on their experience in that role. For that purpose, Researchers A and B prepared a set of open questions to investigate specific difficulties in applying the COPUS protocol, the perceived main differences in observing the first and the second time, the perceived differences of students'/instructor's behaviors, and the perceived difficulties of observing group work. Then, the researchers prepared the semi-structured interviews, that were held individually in mid January, and conducted by Researcher B who also later transcribed them. The interviews focused on the reasons for participating in the observations, previous teaching experiences, self-reflection on previous teaching practices with the current lens of COPUS observations, and on the role that peer observations could play in faculty development. Finally, observers were also asked to reply to a final question (FQ) about what they would change/adopt in their previous/future teaching practices.

We are going to base our findings on Observers A and B comments written in the COPUS coding forms (**data 1**), the observers' written sentences in the structured feedback after observations (**data 2**), and the observers' replies to the semi-structured interviews (**data 3**). The analysis of these data was then carried on by Researchers A and B, and went through the following steps:

1. Numbering all the statements: every comment in the COPUS forms, each written sentence of the structured feedback, and every reply in the transcript of the semi-structured interviews; then close reading all the statements, individually;
2. Discussing and defining in a holistic way the themes that emerged from the reading;
3. Reaching an agreement on the categories for classifying the data;
4. Individually, classifying the statements for each observer according to the identified categories; then discussing the previous classification, reaching an agreement, and organizing it in 2D tables for analysis.

The step 3 outcome is the identification of two types of categories: the lens used during the observation, that is COPUS or GENERAL, and the eyes with which one may observe, that is WITNESS or TEACHER. Each statement can be uniquely classified as belonging to a pair (LENS, EYES) of those types. Table 1 is an example of a result of step 4, where Researchers A and B numbered from 1 to 46 the comments of the first observation.

Table 1. Classification table of Observers' comments reported in COPUS form during the first observation. Source: by Authors.

(LENS, EYES)	WITNESS	TEACHER	
COPUS	2, 4, 7, 9, 10, 11, 12, 17, 21		<i>Observer A</i>
	1, 3, 23, 24, 25, 31, 32, 33, 34, 36, 37, 38, 39, 43, 45	29, 30, 44	<i>Observer B</i>
GENERAL	5, 6, 8, 13, 14, 15, 16, 19	18, 20, 22	<i>Observer A</i>
	26, 27, 28	35, 40, 41, 42, 46	<i>Observer B</i>

More precisely, the numbers 2, 4, 7, 10, 11, 12, 17, 21 correspond to Observer A's comments left in the COPUS form that are classified as a pair (COPUS, WITNESS), because they explicitly refer to COPUS protocol codes and serve as clarifications about what happened in class without any further pedagogical interpretation. For instance, the comment 2 reads: "Not sure about FUp code, because they are doing a recap test", revealing a doubt about a COPUS code (FUp=Follow-up) being correctly marked. Similarly, the numbers 35, 40, 41, 42, 46, correspond to Observer B's comments, and are classified as a pair (GENERAL, TEACHER) because they don't presuppose any use of COPUS protocol and provide teacher's practice insights. For example, comment 41: "A student anticipates the teacher's solution of a linear system" requires a teacher practice of recognizing patterns of interaction with students about the content. Similarly, the pair (GENERAL, WITNESS) refers to statements that do not

presuppose any use of COPUS and contain neutral observations; while the pair (COPUS, TEACHER) concerns those statements which rely on COPUS and teacher's practice insights.

3. Data Analysis

During the first COPUS observation, see Table 1, Observers A and B provided twenty comments and twenty six comments, respectively. From the total number of comments, we have eleven comments classified as TEACHER and the remaining ones, the majority of comments, classified as WITNESS. Note that Observer B, with more teaching experience, made more comments with TEACHER eyes than Observer A. The pair (COPUS, WITNESS) is what appears most often, which is understandable because the observers were applying the protocol for the first time and realized that they had questions about using specific COPUS codes. But it is interesting to remark that even during this first COPUS observation, the observers started to reflect as teachers, in particular, Observer B did that with the lens of COPUS. For example, the comment 44 by Observer B reads: “MG, because teacher *moves* to show how vectors behave”, using COPUS code (MG=Moving/Guiding). It is interesting to compare the classification difference between this statement 44 by Observer B and statement 20 by Observer A: “The *embodied* explanation seems to engage the students back”, since they are related to the same situation in class. The statement 20 is classified as (GENERAL, TEACHER) since Observer A described the effectiveness of the instructor action using the word “*embodied*” rather than a word related to COPUS codes (e.g., “*moves*”).

Table 2. Classification table of data 2. Source: by Authors

(LENS, EYES)	WITNESS	TEACHER	
COPUS	1, 2, 3, 4, 5, 9	6, 7, 8	Observer A
	13, 14, 15, 16		Observer B
GENERAL	11	10, 12	Observer A
	17		Observer B

Analyzing **data 2**, we see from Table 2 that Observers A and B provided twelve statements and five statements, respectively. From the total number of statements, we have now five statements classified as TEACHER, all of them by Observer A, and the remaining ones, the majority of comments, classified as WITNESS. This unbalance does not come as a surprise, because the open questions within the structured feedback were focused on the participants' experience as observers. Nevertheless, there are statements within the pair (COPUS, WITNESS) that can point to the TEACHER category. For instance, statement 3 by Observer A, when comparing her first two COPUS observation experiences: “The second time, however, everything was more natural and clearer. By being more familiar with the codes, I was able to better *recognize behaviors* and *categorize activities* more efficiently.”. In this statement, Observer A mentioned terms which

can be related to teacher's practice: class management ("*recognize behaviors*") and lesson format ("*categorize activities*").

Table 3. Classification table of data 3. Source: by Authors

(LENS, EYES)	WITNESS	TEACHER	OTHER	
COPUS	2, 14	3, 4, 6, 7, 9, 35, 37, 38, 39, 41	2, 8, 10	Observer A
	17, 24	25, 26, 27, 28, 44, 47, 48	33	Observer B
GENERAL	12	1, 13, 15, 36, 40, 42	5, 11	Observer A
		16, 18, 19, 20, 21, 22, 23, 29, 30, 31, 32, 43, 45, 46	34	Observer B

Table 3 reports the results of the classification applied to **data 3**, the semi-structured interviews. Observers A and B provided twenty-four and twenty-five statements, respectively, being only five of them classified as WITNESS. A further category was identified for such type of data, namely the broad academic eyes of a faculty member, here named OTHER. For example, in the pair (COPUS, OTHER), we find statement 8 by Observer A: "I think that peer observations are very important. COPUS protocol allows for complete and extensive observations.". During the semi-structured interviews, the observers reflected a lot as TEACHER using the lens of COPUS. For example, in statement 41, Observer A said on FQ: "Using lecture notes already written, like prepared slides, force students to be busy in *copying* and *not listening*... I will do only *writing* during class or give notes to students in advance." The statement is classified as COPUS since Observer A used the COPUS code "*listening*", even if she emphasized that students do not listen to, but just "*copy*" what they see. This statement also suggests a future improvement of the teaching practice, because she intends either to provide notes in advance or to *write* in real time.

The analysis also highlights how very long moments of frontal lesson are less effective for student engagement. Both observers reflect on that, proposing a different approach to avoid similar moments in their future teaching practices. Observer B with statement 48 (COPUS, TEACHER) commented: "There were long moments (marked in *every 2 minutes*) [...] when only *Lecturing/Listening* was happening; I observed how many students started little by little to become more absent... I will try to pause more often, posing questions to students, not necessarily *clicker questions*...". Similarly, with statement 42 (GENERAL, TEACHER) Observer A said: "I observed that the frontal part of the lesson on integration was hard for students, but I still don't know how to improve this. Maybe preparing something in advance to give the students before they come to class... perhaps having a MOOC on that subject.".

4. Discussion and Conclusion

This work aims at investigating the potential of flipped peer observation in faculty development, more precisely it addresses the following research question: how the flipped peer observation model, implemented with the COPUS protocol, can support the reflection of early-career STEM

faculty members (“young faculty”) on teaching practices? The study resorts data collected in three different moments of an Elementary Mathematics course in fall semester 2024/25.

The analysis of **data 1** reveals that during the COPUS observation, the young faculty have reflected on teaching practices related to the lesson format, the types of tasks, and class management. However, when young faculty are asked to provide feedback on their observation, it turns out that the questions should be very explicit and specific. Indeed, the analysis of **data 2** shows that Observers A and B made comparatively less statements with TEACHER’s eyes than during observation moments. Note that Observer A, less experienced young faculty, made more comments in that moment with TEACHER eyes than Observer B. Somehow, the fact that the Researchers A and B did not ask explicitly for reflections on teaching practices narrowed the feedback on pedagogic issues when applying COPUS protocol. On the other way around, when Researchers asked explicitly for a reflection, Observers A and B behaved differently. Indeed, **data 3** analysis shows that young faculty may provide many insights as teachers, such as class management, lesson format and recognition of pattern of interactions, so that they can critically reflect on their own past teaching practices and suggest some changes for the future.

Even though we know this is a preliminary study which involved only a limited sample of observers, the results seem promising in the direction of the young faculty development. Moving back on the research question, we can conclude that flipped peer observations with COPUS, along with specific moments of well-prepared feedback and interviews by young faculty, prompt them to think more with teacher’s eyes, and thus led them deeply reflect on their own teacher practices. In future, despite the issues involving many faculty members, we aim to evaluate the effectiveness of flipped peer observation by setting up a large study.

References

- Anwar, S., & Meneske, M. (2020). A systematic review of observation protocols used in postsecondary STEM classrooms. *Review of Education*, 9(1), 81-120. <https://doi.org/10.1002/rev3.3235>
- Bandura, A., & Walters, R. H. (1977). *Social learning theory* (Vol. 1, pp. 141-154). Englewood Cliffs, NJ: Prentice hall.
- Bullough, R. V., & Pinnegar, S. (2014). Guidelines for quality in autobiographical forms of self-study research. *Educational Researcher*, 30(3), 13-21. doi: <https://journals.sagepub.com/doi/10.3102/0013189X030003013>
- Da Ponte, J. P., & Chapman, O. (2006). Mathematics teachers’ knowledge and practice. In A. Gutierrez & P. Boero (Eds.), *Handbook of research on the psychology of mathematics education. Past, present and future* (pp. 461-494). Sense Publishers.
- Dillon, H., James, C., Prestholdt, T., Peterson, V., Salomone, S., & Anctil, E. (2020). Development of a formative peer observation protocol for STEM faculty reflection. *Assessment & Evaluation in Higher Education*, 45(3), 387-400. <https://doi.org/10.1080/02602938.2019.1645091>

- Dougherty, B.J. (1990). Influences of teacher cognitive/conceptual levels on problem-solving instruction. In G. Booker, P. Cobb & T.N. Mendicuti (Eds.), *Proceedings of the 14th PME international Conference* (Vol.1, pp. 119–126). Oaxtepe, Mexico: PME.
- Gosling, D. (2002). *Models of Peer Observation of Teaching*. Learning and Teaching Support Network (LTSN).
- Gunersel, A. B., & Etienne, M. (2014). The impact of a faculty training program on teaching conceptions and strategies. *International Journal of Teaching and Learning in Higher Education*, 26(3), 404-413. <http://www.isetl.org/ijtlhe/>
- Smith, M. K., Jones, F. H., Gilbert, S. L., & Wieman, C. E. (2013). The Classroom Observation Protocol for Undergraduate STEM (COPUS): A new instrument to characterize university STEM classroom practices. *CBE—Life Sciences Education*, 12(4), 618-627. <https://doi.org/10.1187/cbe.13-08-0154>
- Sundset, M.A., & Sandvoll, R. (2022). Academic development through a collective approach - introducing peer observation of teaching in a multidisciplinary faculty. *Nordic Journal of STEM Education*, 6(1), 16-27.
- Wimberg, C., Adendorff, H., Bozalek, V., Conana, H., Pallitt, N., Wolff, K., Olsson, T., & Roxå. (2018). Learning to teach STEM disciplines in higher education: a critical review of the literature. *Teaching in Higher Education*, 24, 930-947. <https://doi.org/10.1080/13562517.2018.1517735>
- Wood, T. (1996). Teaching to create discussion as mathematical argumentation. In L. Puig & A. Gutiérrez (Eds.), *Proceedings of the 20th PME International Conference* (Vol.4, pp. 427–434). Valencia, Spain: PME.