A FACULTY TEACHING COMPETENCE ENHANCEMENT MODEL: A MENTORING APPROACH

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ABSTRACT

This paper addresses a model for faculty teaching competence enhancement (standard 10), implemented in the department of civil engineering at UCSC. The method used was very similar to that of an apprenticeship and the term "transfer" was coined to describe this process, being this a familiar term used in engineering innovation. The transfer process has several stages, the first being breaking the old teaching paradigms. This is a crucial stage for creating awareness of the students' learning process: How does the human brain learn and what kind of active learning activities lead to meaningful learning? This understanding makes it evident for the teacher apprentice that the teaching methods must be student centered because students must build their knowledge and understanding through their own learning process. Therefore, as a result of this stage, teachers realize that their job is no longer to just prepare good lectures, but to plan out the students' learning process and come up with active learning experiences to induce this process. The other stages that are part of the proposed model are described more extensively in the paper. The transfer process was done for the statics course, which had already been redesigned under a CDIO approach (Loyer, 2013) (CDIO standards 1, 6, 8). The results of this experience have been positive for both faculties and set a new standard for faculty enhancement in the department. In the opinion of the apprentice, this was an efficient way to transfer know-how, because it occurred in one semester and it combined his training and "teaching job" in the same room.

KEYWORDS

Faculty enhancement, apprenticeship, mentoring, active learning, learning cycles, learning process, Standards: 1, 2, 5, 8, 9, 10

INTRODUCTION

Faculty enhancement is a big challenge, if not the greatest, when implementing a CDIO curriculum or any student centered/active learning approach. In the case of Chilean Engineering schools, most have relied on traditional "training" techniques, such as courses, seminars or workshops, given mostly by educational experts. Workshops are among the most effective training mechanisms, because they allow for expert guidance through the process. But how far can this guidance go, considering that their expertise is not in the specific field that the trainee must teach? A few of these experts have acquired enough engineering expertise to help them guide them all the way, but this is a rare case. So, this begs the question: How do we prepare our Engineering teachers for this new era? Should all faculty go through the same process or should distinctions be made depending on the

teacher's profile? And how do we make the most of the existing know-how of the early adopters?

The first lesson learned during the design of the Civil Engineering curriculum under a CDIO approach (Loyer et al., 2011), was that we should view all these processes as engineering processes themselves being this is also applicable to Faculty enhancement. Therefore, seen as a process, a model for enhancement of teaching competences was developed and applied during the first semester of 2013 in the Statics course, which had already been redesigned under a CDIO approach (Loyer, 2013). During the design of the model, several instruction methods were revised, but the main unanswered question was how to benefit from the existing know-how and expertise of senior faculty members that already had years of successful experience. After going through several methods, a mentoring approach was adapted to the model and weaved in with other active learning instructive methods as well as with some management principles.

THE LEARNING PROCESS, ACTIVE LEARNING AND MENTORING

When designing the teacher competence enhancement model we were faced with the fact that the teacher subjected to this enhancement process would undergo a learning process himself so it wasn't so different from designing and planning lessons and activities for our students.

Active learning can be defined as any instructional method that engages students in the learning process (Prince & Felder, 2006). Therefore, it requires students to do meaningful learning activities and think about what they're doing (Bonwell & Eison, 1991). This same author states that not only does it motivate students for further study, but also helps them develop thinking skills and better attitudes. Active learning shifts students from a passive to an *active mode,* term coined during the development of this experience to describe the attitude that we're looking for in the student (or in this case the teacher apprentice).

An instructional model should involve *learning cycles* that consider different activities to appeal to different learning styles (Felder, 1996). Kolb's experiential leaning model is a good example (Kolb, 1984), but many others have been developed (Prince & Felder, 2006).

Some active learning methods are inductive teaching methods based on a constructivism model which leads to metacognitive skills (Prince & Felder, 2006), like diagnostic teaching, inquiry teaching, just in time teaching, problem based learning (PBL), etc. Prince (2004), states that, although there is consensus on the general definition of PBL, there is a wide range of ways to implement it. Several authors consider *just in time teaching* as an instruction model that combines classroom activities with other activities that allow the students to give feedback to the instructor before classes, allowing him to adjust his class accordingly. However, we also use this term to describe the logic behind the design of the PBL for the Statics course. Problems are designed so that the main topics and concepts are introduced gradually (not all at once, as traditional lectures normally do), and the teacher's explanation or introduction of a new concept comes "just in time" once the students have reached a certain level of difficulty in a problem and can't continue on their own (Loyer, 2013).

Mentoring and *apprenticeships:*. According to Webster's Dictionary, a mentor is "someone who teaches or gives help and advice to a less experienced and often younger person". The same dictionary defines an apprentice as "a person who learns a job or skill by working for a

fixed period of time for someone who is very good at that job or skill". So one of the main differences is that the apprenticeship is done "on the job". Also, they have a spin-off effect which is creating relationships: the core for creating teaching communities. The more experienced person is called the mentor, while the one being mentored is called the protégé, apprentice, or mentee. Research supports the use of mentoring for faculty enhancement as a means to improve teacher retention (Smith & Ingersoll, 2004).

FACULTY TEACHING COMPETENCE ENHANCEMENT MENTORING MODEL (FTCEMM)

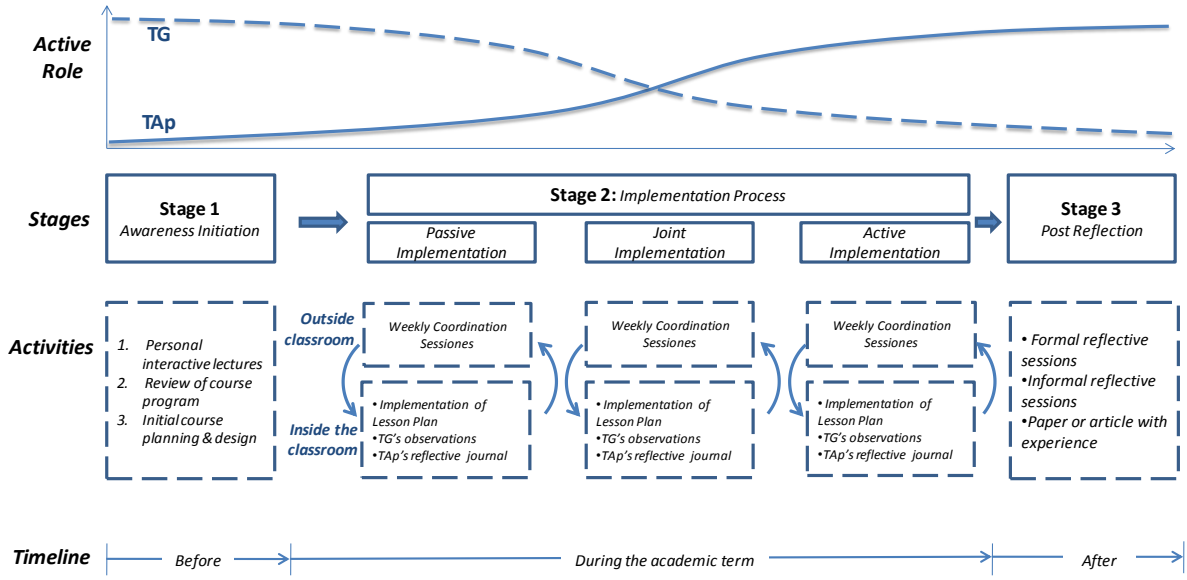

Figure 1. Faculty Teaching Competence Enhancement Mentoring Model

Figure 1 shows the complete 3 stage transfer model (FTCEMM), implemented at UCSC. Although it's presented as a mentoring model, it takes from the apprenticeship model the "on the job" aspect, since both teachers take on the course together and their role evolves during the academic year, as can be seen in Figure 1. We will refer to the teacher with more experience as the Mentor Teacher, or Teacher Guide (TG) who must transfer his know-how to the other faculty member with less experience or Teacher Apprentice (TAp).

Like any learning process, the TAp will undergo a learning cycle. In this case, we adapted Kolb's learning cycle (Kolb, 1984) into the. Only one of these stages take place inside the classroom, as can be seen in figure 2. Further understanding will come from reading the description of stage 2 and from the model scheme on Figure 1.

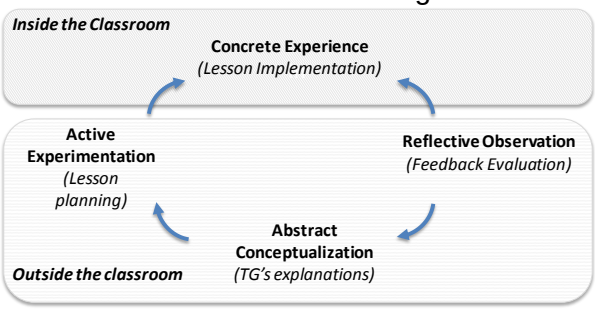

Figure 2. TAp's Learning Cycle (Adapted from Kolb's Learning Cycle Model) (Kolb, 1984)

Stage 1: Awareness Initiation

This is the most important part of the process and it takes place before the beginning of the academic term. This is where the changing of the old paradigms start. If the TAp isn't convinced that changes in his teaching methods will make significant improvements in the student's learning process, then there's no sense in going on. By improvement we're not referring to getting better grades, but for the students to obtain meaningful learning. Therefore, the task at hand for the TG is to produce the change of mind that will lead to the TAp's awareness of how students learn.

How do we change the paradigm?

Several strategies are needed to start the awareness stage. This stage is not about the contents of the course but about what the TAp doesn't know: What is learning and what's a learning process? How do people learn and how does the brain work in order to produce significant learning? What other aspects are needed to make this process even more effective? Although some concepts and techniques from educational theories are important at this point, there's no need to go into effective teaching methods yet.

The change of paradigm is an internal process that requires a period of time in which the TAp must not only learn the above, but also see its results. So it starts before the course, but continues and strengthens during the semester. How do you convince an engineer? With facts and experimentation (see to believe). The TAp is going through an active learning process himself, so just as with our students, you can't expect good results with a traditional approach, so it's pointless to just lecture the TAp on it, or give him a list of authors to read.

Activities for Stage 1:

The *first activity* consists of a series of ***"personal interactive lectures".*** These meetings have to be previously designed and planned, not improvised. They should be done in a comfortable place for both, like their own office. It's not just a talk. There's a learning process at hand, so active learning strategies must be used. Also, this an engineer/scientist, not a teenage student, therefore everything must be grounded and with a scientific support if we intend to make a change of mind (facts are of the essence). We recommend the use of PowerPoint presentations (or other TICs), since it can be of great help. It gives a certain formality to the activity and helps structure the meeting while also giving an important visual support. Every topic addressed must also have an example that allows contrasting the traditional approach with an active learning approach in terms of the different results in students' learning. Since it's an interactive lecture, an inquiry approach is strongly recommended, as we need the TAp to constantly reflect on these matters and his own practice by comparing and bringing his own experience to the discussion. Therefore, when giving examples, the TAp should be the first one to come up with them. The topics to cover are the following: a) What is learning & learning styles b) How the brain learns and its relation with an active learning c) Data from empirical studies that give proof of the improvements when using active learning techniques. Presentations must not be complicated nor long: it is best to keep them simple, there will be time to add more complexity. If you present too much information at once, it doesn't work (just like with our students), the teacher apprentice needs time to assimilate everything, so the information must be given just in time. These talks will then be articulated with the classroom activities once the semester starts, as part of the TAp's teaching/learning process. The TAp needs to experience in class what has been previously discussed, and then move on to the next topic.

The *second activity* is to go over the course program or syllabus together. In doing so, before actually revising these documents, it's vital to have a clear idea of the TAp's notion of the course. So we start by revising the learning outcomes. To begin, without looking at the program or syllabus, the following question must be answered by the TAp: What should the students learn or learn to do by the end of the course and in what level of proficiency? When working with teachers with little CDIO or active learning experience, the most common answer is that they list the contents of the course (ALL of the contents). Therefore, the TG's role is to lead him to visualize the final outcomes that you expect from the students. This is the moment when the TG must introduce the concept of learning outcomes and the difference with a specific topic or traditional course objective, and the TAp must also prioritize them. Once this process is over, both should agree on the result which is none other than a list of learning outcomes for the course. Then, these learning outcomes must be compared to those listed in the course program or syllabus. In the case of courses that are already under a CDIO approach, these results might be very similar, but the learning process the TAp went through is priceless. Secondly, all learning outcomes must be assessable, and the best way to lead the TAp in this understanding is by having him determine how each one of the previous learning outcomes could be assessed (general assessment tool or strategy). At this point, it's just an awareness strategy, since the specific assessment strategy, planning and design will be done later on. This could be filled out in a chart form as a way to map out this information which is more visual for the TAp. Thirdly, after the previous exercises, it's useful to have the TAp look at the course's contents. Normally, changes can't be made in a formal course program, but reflecting on them is very helpful or even questioning if the order in which these contents are presented is the most effective way for students to obtain meaningful learning, now that the learning outcomes are more internalized by the TAp.

The ***third activity*** consists in the initial planning and activity design of the course. First, a very general planning is recommended for the whole semester (mostly mapping out the contents in a very general schedule), since once the TAp learns more, changes will be made to the original schedule. Nonetheless the planning of the first few weeks must be done in detail. Normally, you would have a complete syllabus at the beginning of the semester and if that's the case, that will do for now, but it's important to keep in mind that this a teaching competence enhancement process, so some things will be done differently or with a different timing, so flexibility is needed in terms of course planning. At this stage, most of the innovation ideas will come from the TG, so it's important to keep a balance between the amount of innovations (you don't want to overwhelm the TAp) and the TAp's level of comfort with them. At first, he may be more reluctant to embrace certain changes, so the TG is the driving force that must keep the TAp motivated while juggling with his fears and anxieties.

Stage 2: Implementation Process

This stage is subdivided in three sub stages related to the evolution of the TAp's learning process. The activities developed in each sub stage are divided in 2 groups: inside the classroom and outside of the classroom, as shown in figures 1 and 2. In order to carry out this stage in an effective and efficient way, it's essential to bring to our practice some management principles which can be summed up in what we call the course management cycle.

Course Management Cycle

Course planning and activity design is an arduous task and it becomes even more complex during a TAp transfer process. As a process, a management cycle must be adopted, in order

to have a continuously improvement process, as shown in figure 3. We recommend this type of course management always and not only when implementing the enhancement model.

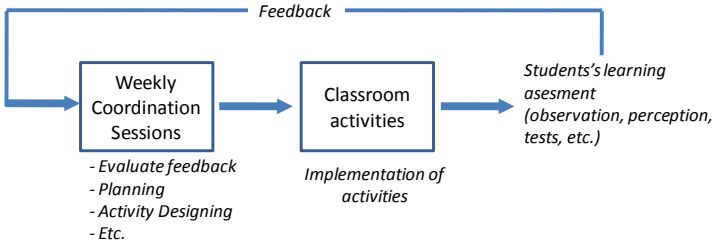

Figure 3. Course management cycle

Weekly coordination sessions (WCS) with both teachers are the core of the course's management system and their main objectives are planning, designing and also evaluating the course development, as a means of feedback that will affect the planning and design of the course for the following weeks. These cannot be casual meetings and should always start with a discussion of student progress during the previous week. The resources used for this reflective discussion are: summative or formative evaluations (if any) and teacher and teacher assistants' perceptions from observing the students work during the previous week. This assessment (done on a weekly bases), provide the feedback needed to improve the lessons planned and designed for the students. This is not always the case, since many teachers don't give proper use to this information, but by having WCS, you are forced to.

Passive Implementation Stage

Although it's the first part of the implementation stage, it's also considered an awareness stage, since it's the TAp's first encounter with active learning techniques within the classroom, so this is when his conviction starts due to the first results that he is able to witness.

The activities start *outside of the classroom* in the WCS. They must be done in an active learning way, so they must never start with an explanation by the TG. Instead, the TAp must have an active role in the context of the course planning and design. The activities are:

1. The TAp is asked to reflect on the objectives or outcomes of the lesson that they are planning at the time, putting him in an active mode. Normally, a teacher would list the contents that should be covered, but thanks to the previous work done with the TAp in the awareness stage, he is now able to differentiate these and visualize more clearly an outcome. These are discussed with the TG and a consensus must be reached.
2. Now the lessons must be planned for the previously recognized outcomes. The TAp is the first one to suggest how to do it in order to maintain him in an active mode, but also allowing the TG to have a clear idea of what's on the TAp's mind at that moment, so in a way, it assesses his progress. The role of the TG is to guide this work, suggesting some innovations or changes in the lectures or adding other active learning techniques. This is the moment when the TG presents some active learning techniques (the ones that may be more suitable for the lesson at hand). This must be done in a formal organized way, so the TG must have his PowerPoint presentation or any other support materials at hand to help him in this task. Each technique must be well explained and justified as to why it works or doesn't and what are the effects. It's likely that the TAp might disagree on some proposals, since this might be all new to him, so the TG's role is crucial. Sometimes you can't get through to some people but they may be willing to try. In this case, the TG must ask the TAp to take a leap of faith: "Trust me, I've done this before so I know it works, so just try it and we'll see".

3. For each outcome, determine how it will be assessed. As before, first ask the TAp to come up with ideas to do this, opening up a discussion with the TG. This is the moment when the TG lectures the TAp (in an interactive way and using support material), about assessment (principles, types of assessment, specific assessment techniques, etc.). As always, this task must be carried out in a formal organized way and not improvised.
4. If the TAp hasn't done it already, this is the best moment to give him some articles and books to read. He is motivated and seeing results, so is probably willing to learn more.

After the lesson planning, start the activities *inside of the classroom* . The role of the TG can vary depending on the course and the evolution of the previous work. TG and TAp can have a joint teaching role (take turns, for example). The benefits of joint teaching is that the TAp gets a chance to see his colleague in action, and can observe some of the students' reactions to active learning and how they become more autonomous. Inside the classroom is where most of the learning happens for the TAp. It's like a hands-on lab but with a mentor close by to guide you. The activities carried out in the classroom should go according to the lesson plan. The TG has an important role as an observer and must bring objective feedback to the WCS. Sometimes he can make direct observations in class, but just as long as the students' don't perceive it. The TAp had objectives and a plan at the beginning of the class, so at the end he must reflect on the outcome of the experience. He should carry a reflection journal and after each class (not the next day), he must reflect on some of the following questions: What worked? What didn't work and why? Did the students learn? Do I know if the students learned? What could have I done different? Did the students engage in the process?, etc. These reflections, along with the TG's observation are taken back to the WCS as feedback to help them plan the following lessons, and the cycle starts again.

Joint Implementation Stage

In this stage, we repeat the same activities as in the previous stage, following the course management cycle. The main difference is in the role that the TAp and TG take. Upon reaching this stage, the TAp has already worked together with the TG in the lesson planning and active learning design, witnessing in the classroom some results in terms of student behavior and their learning process. Therefore, in this second phase the TAp assumes a more active role outside as well as inside the classroom. Just like we expect from our students, the TAp is acquiring a higher level of autonomy.

Some changes in the TAp's role *outside of the classroom* are that he's able to bring more to the table when planning the lessons as well as when designing the assessment tools and strategies, so his feedback is much more significant then at the beginning. Depending on the course, he will come up with more hands-on activities that can be implemented. He's starting to become a peer in terms of teaching competence, so now they work more side by side. The TG's role is still that of a guide, but now he's not the only driving force in these meetings. He's there to keep the balance, supervise and give his more experimented advice.

The TAp is now much more effective *inside the classroom*. He feels more comfortable and is no longer afraid to innovate. He's able to guide the activities inside the classroom in a much more fluid way. The TG's presence in the classroom is still necessary as an outside observer, but now it's easier to switch roles with the TA as the main teacher inside the classroom and they're able to compare notes while the students are working autonomously. Also, the TAp has developed some assessment skills like observation of student performance as well as other tools than can easily be applied in the classroom. He has also improved his guidance role when students are working collaboratively or autonomously, maintaining a good pace.

Active Implementation Stage

Once again, we repeat the same activities as in the two previous stages, following the course management cycle. The main difference relies also is in the role that the TAp and TG take.

Outside of the classroom, the TAp is capable of planning lessons, design hands-on activities and assessment tools on his own, with little help from the TG, which now acts more as a peer in the WCS. *Inside the classroom*, the TG no longer needs to observe his classes all the time, so the TAp can work more autonomously. Therefore, the weekly class schedule can be changed alternating days among both and leaving one session with both present in the classroom, in order to make the change more smooth for the TAp as well as for the students. In these cases, they must work autonomously when hen students are working autonomously and coordinated in the case of lectures. Some level of observation from the TG is still recommended, in order to have better feedback in the WCS.

Stage 3: Post Reflection

This is a stage that actually starts during the semester and goes on long after the academic term is over. This gives strong feedback that helps improve the teacher's performance (TAp and TG), as well as the course planning and design. This must be done in a formal way at first (schedule a few meetings at the end of the academic term), as well as informally. The last is the most common way since normally teachers that have moved from a traditional to an active learning approach have had a life changing experience, therefore they can't stop talking about it, so these topics will come up in meetings, hallways and even social events. The important thing is to have a few formal encounters. This is where the TAp's reflective journals come at hand. The results of these final evaluations should be put down in writing in the form of a research paper or a reflective document that can be shared with other faculty, but the first is highly recommended, since it gives a more scientific approach to the whole experience. In a natural way, these new relationships set a base for a teaching community.

IMPLEMENTATION OF THE MODEL IN THE STATICS COURSE

Statics Course

The model was implemented as a pilot experience in the Statics course of the Civil Engineering program. It's a third semester course that had already been redesigned using PBL (peer facilitator and floating facilitator model), were students work in groups of three while teacher and teacher assistants move from group to group in class answering questions and probing for understanding. The course requires the use of concrete materials on a daily bases during problem solving sessions, and formal hands on activities designed for specific learning outcomes. At the end of the course, students must develop a project with a real life structure. For further reference of the course design, refer to (Loyer, 2013).The TAp was a professor, who was a Civil Engineer, with no previous CDIO experience and who had a traditional teaching approach. For this purpose, he was teamed up with another Faculty (an Engineer as well), who had 14 years of active learning experience (TG).

Implementation Stages

The model was implemented as described previously and the first half of *stage 1* went very smoothly. The TAp went through a learning process facing many facts that support active

learning, motivating him and therefore starting his awareness process. But difficulties emerged during the first lesson planning. The TAp was used to traditional lectures, so it was hard for the Tap to rely less on his lectures. Facts and faith in the TG made the Tap give in and try these new approaches.

The *second stage* started with some difficulties due to the gap of experience in active learning between the TAp and TG. It was still hard for the TAp not to rely so strongly on lectures and he insisted on keeping them. He had a feeling that "if I don't say it then they won't know it", so he had an urgent need to explain everything, even if the students had already understood. This is quite common and the feeling started to change once the TAp began witnessing active learning in action and specially the students' response in terms of their learning outcomes. He began believing.

By the end of the academic term (*stage 3*), the TAp assumed a very active role in lesson planning and design and came up with several new hands-on activities that were incorporated to the course.

RESULTS AND DISCUSSION

By the end of the academic term, the TAp was a true believer of active learning techniques and was very familiarized with the theories that support it. He became an informal spokesman of educational issues within the Department and has been since then implementing changes in his other courses on his own. Because of how the model was designed, the transition process for the TAp was gradual. He was able to witness little by little the results and he wasn't forced to change completely from the very beginning. He gradually went from a passive to an active role during the academic term. The role of the TG is very important in the beginning stages. He must keep the TAp motivated in the middle of his change process.

The TAp went through an active learning process during the whole academic term, and his learning came from the active role that he assumed during the whole process as well as witnessing the results in the students. There's a long list of observations that served as evidence for the TAp to embrace active learning techniques, some of them are: a) Better understanding of fundamental principles. b) More reflective students v/s mechanical problem solving. c) More confident students willing to deal with new problems even if they didn't have all the tools or prior know how. d) Concrete materials helped the students visualize the problems better, and understand better the concepts and were later referred to further when introduced to new concepts and applications. e) Significant changes in the students' working habits, going from a passive to a much more autonomous and structured role. f) The importance of emotions in the learning process and motivation as a driving force. g) Putting the topics in the context of civil engineering not only facilitates the understanding but also motivates students. h) Students ask less but better questions outside of the classroom.

Even though the mentoring concluded, the relationship generated between the TAp and TG is long lasting, and they've continued sharing experiences and asking each other for advice on different matters. This is how teaching communities are built.

Having 2 teachers dedicated to the same course during an academic term is a high cost for the school, but it must be seen as an investment, since it's a much more effective way to enhance teaching competencies. After the term is over, the TAp must get support from the teaching community.

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BIOGRAPHICAL INFORMATION

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