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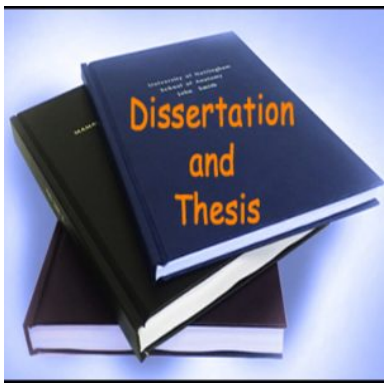

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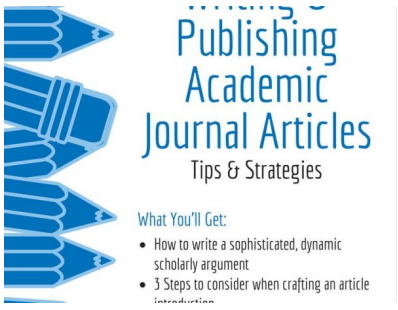

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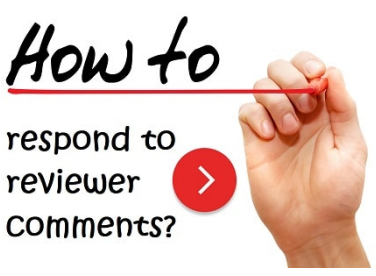

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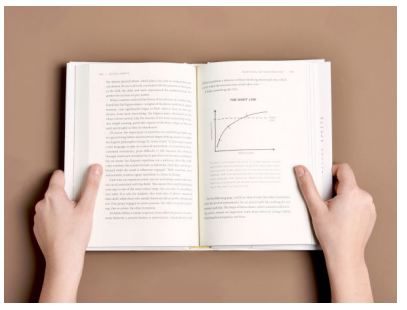

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Modeling and pedagogy

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Abstract

The depth of knowledge a student will develop while building a model, the memories and skills they will gain that transcend content, and the teamwork they will develop during the process are just a few of the benefits of the modeling process. Ultimately, the modeling process will allow students and teachers to experience education in a way that matches the way work is done in scientific research, engineering, and other professional settings. Having students build models to solve problems is an enormous goal and enormous goals require enormous planning. The purpose of this guide is to outline the pedagogical approaches a teacher will need to lead their students on the journey from novice modelers to expert modelers.

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Education

Modeling and pedagogy

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The depth of knowledge a student will develop while building a model, the memories and skills they will gain that transcend content, and the teamwork they will develop during the process are just a few of the benefits of the modeling process. Ultimately, the modeling process will allow students and teachers to experience education in a way that matches the way work is done in scientific research, engineering, and other professional settings. Having students build models to solve problems is an enormous goal and enormous goals require enormous planning. The purpose of this guide is to outline the pedagogical approaches a teacher will need to lead their students on the journey from novice modelers to expert modelers.

Introduction

One of the best ways to help students understand new knowledge or get a grasp of difficult skills is through modeling and scaffolding, which involve the teacher showing students how things are done. Too often in education, teachers make the assumption that students already know exactly what they need to do. More often than not, this is not true. Students will benefit from watching the teacher model a skill or activity. Students are incredibly influential and will look to the teacher for examples on how to act, what to do, and how to succeed. Here are some different ways you can model for the students:

1. **Model desired personal characteristics:** Present theself as a role model for optimal behavior during a lesson. At any given time in the classroom, you are asking students to be responsible, creative, diligent, thoughtful, and respectful (to name a few). Students are more likely to meet these expectations if they see you meeting them as well.

1. **Model a task:** Let's say you want to teach active reading and annotation strategies to the students. You can do one of two things. You could tell the students exactly what they should do and let them do it, or you could show them what they should do, and help them work on it. Select a piece of reading, and read it with the class, annotating it in the same way you expect the students to annotate. This way, there will be no confusion about what you are expecting from them.

1. **Model metacognitive thinking:** When you are trying to help the students become better thinkers and arrive at conclusions more efficiently and effectively, it can help to show them how the thought process works. In math class, this works perfectly because you can walk the students through the process of solving a problem. In language classes, you could walk the students through how you would break down a word for proper pronunciation and potential meaning.

1. **Let the students do the modeling:** Assess the students strengths and weaknesses, and give them opportunities throughout the year, or course, to model their strengths to the class. Not only will you be reinforcing their success and solidifying their mastery of the skill, but you will be letting students learn from other students.

In whatever way you choose to use modeling, you will make a huge impact on how well the students understand the skill or knowledge you are working on. Sometimes, students need to see how it is done, not just hear how it should be done, in order to find success.

Planning for assessments

Instruction planning is not an aimless adventure where teachers decide what they are doing as they go; it takes a lot of forethought. In order to be effective as an educator, you have to understand what you are leading to on day one, and categorically take steps to prepare the students to reach that goal. In order to be an effective teacher, you have to know where you are going, and if you want to have an impact on the students, you should also let them know where you are going.

Backwards planning is an educational strategy that helps teachers make sure everything they do leads to their assessment. It is a pretty simple idea, though it is fairly difficult to execute perfectly. Here are the steps you need to take if you would like to implement backwards planning.

First figure out exactly what you are trying to do with the unit you are planning. At the end of the unit, what are you hoping the students will be able to do? These are the unit objectives, and should be created with care because everything you do during the unit will have to work toward these objectives. When you are creating these objectives, focus on what the students will be able to do by the end of the unit rather than the content you want to cover. The ultimate goal is to lead the students to success, not get to a specific point in the curriculum.

Design an assessment in line with the objectives you created. If the objectives are an expression of what the students should be able to do by the end of the unit, then the assessment needs to assess whether the students are able to do these things. Think of it this way: if you bring the car to a mechanic and they tell you they will fix the car, you will assess their success by whether the car is fixed when they are done with it. If you say the students will be able to do A, B, and C by the end of the unit, you need to assess whether they can do A, B, and C at the end of the unit.

Now that you have created objectives and designed an assessment, you need to figure out what the students will need to achieve the objectives. What skills do they need to improve on? What knowledge do they need? What do they need to practice? What steps do they need to take to get to the point where they can be successful on the assessment, and therefore fulfill the objectives?

Design a unit worth of lesson plans to target the specific skills, knowledge, and areas you have identified as necessary for the students to find success. The whole planning process is recursive. Make objectives, make a tool for assessing whether students have reached the objectives, identify what the students need to succeed on the assessment, and design instructions that target the students' needs.

After you have taken the students through the unit and graded the assessment, it is time to reflect on the teaching. The objectives were to help the students be able to do A, B, and C. Were you successful? Did enough students succeed that you can move forward without worrying about their progress? If students did not succeed, what kept them from succeeding? How can you do things differently the next time you implement the unit to ensure that the students are more successful?

There are two ways in which the previous reflection can inform the teaching. First, redesign the unit so it more effectively helps students achieve the objectives. Next year, when you teach the unit, you should have more success. Second, what skills did the students miss in this unit that they will need in the next unit? Their performance in this unit should inform the planning of the next unit. If the majority of students do not get the skill you were planning for them to hone, then it should become one of the objectives for the next unit. You cannot write them off and hope for better results next year. You need to make up for it with these students, and adjust the instruction so that it is more effective next year.

Constructive critism

The process we discussed in the previous section does not fall only on the shoulders as the teacher. Great teachers make the students a part of the process, asking them to reflect on their own learning, and identify what kept them from finding success. In order to do that, they need to receive honest and specific feedback from you on their performance. Telling a student “good job” isn’t going to help them improve at all. Honesty is important, but it is also important that you are sensitive to the fact that excessive criticism could simply demotivate the students. Here are some tips for providing the students with constructive criticism:

First of all, you need to make sure the expectations are very clear to the students. If they properly understand what is expected of them, you can get a true picture of what they are able to accomplish, and they don’t feel blindsided by the feedback. If you have the opportunity, you may want to provide the students with examples to show them what a successful assessment looks like as opposed to an unsuccessful assessment.

When you are providing feedback, be specific. Vague, general feedback is worthless. You are already going to have to overcome the obstacle of students not paying attention to the feedback; if you provide meaningless feedback, they are even less likely to focus on it. This is important when you are giving feedback on what they did well as much as it is when you are providing feedback on their weaknesses.

Try to balance the positive and negative feedback. Never only provide negative feedback; there is always something good you can say. While a student will be upset getting negative feedback, it will definitely help that you have provided a silver lining so they see their work was not worthless.

Refer back to the instruction. If students are struggling with something you have not taught in the unit, then it is something you will have to discuss with them; if it is something you have gone over, then you will probably have to go over it again. When the students are struggling with something you haven’t taught, it may not be fair to punish them for it, so instead provide encouraging feedback that identifies the weakness and promises you’ll discuss it as a class.

Require the students to do some sort of reflection activity that forces them to read or review the feedback you have provided. If they do not receive the feedback, what is it accomplishing?

CONCLUSION

This literature review provides a unique and needed review that considers pedagogy in terms of the functions, discursive means, and the technologies used to shape student learning. Through this work, we have been able to understand the modeling pedagogies that have been enacted and investigated, the pedagogical functions of these pedagogies, the critical discursive acts within these functions and pedagogies, and the role technology has played within the pedagogies identified.

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