



## WHAT WORKS - PKAL F21 COMMENTS

# IMPRESSIONS OF STUDENT LEARNING I

**Project Kaleidoscope:** *If a visitor were to come into your classroom/lab, what impression would they leave with about the learning experiences they see the students having?*

**Kira Hudson Banks:** A visitor would see service-learning in action. One of the goals is to engage students in hands-on experiences in the community. I do this through having students mentor middle school girls through the research process. By teaching the scientific method to others, my students solidify their own knowledge.

**Robert C. Ekey:** A visitor to my classroom would find a relaxed and active atmosphere where the students are encouraged to ask questions and learn through peer discussion and physical observation.

Based on the ideas discussed, problems attempted, and demonstrations viewed, the visitor would hopefully get the sense that applying the concepts is as important (if not more) than being able to solve a particular problem.

**Mark M. Levandoski:** I try to incorporate a variety of active-learning pedagogies in the classroom and laboratory. What I believe is common to all of these approaches is the concept that students must be engaged with the material in order to learn it well. Therefore, not only must they come to class prepared, but they must solve problems and analyze content while in class.

I try to assess the students' work on this same basis, and I find it a better format for determining how they think as opposed to what they know. I can't be certain that the success of this methodology would come across to a visitor, but I hope at least such visitors would find that students participate.

**Elizabeth F. McCormack:** In our introductory physics lab they'd see students engaged in multiple, open-ended experiments designed to highlight the processes of the scientific enterprise as well as particular content. For example, in one part of the lab they might see three different kinds of pendulums being investigated, next to a pair of students exploring the physics of music, next to a pair looking at material crystal structures using the latest software, next to another pair measuring waves on a wire.

Hopefully the impression they would take away would be one of curiosity and energy, and of course, community: people having fun together. They might also take note of the power of peer learning that emerges from a structured but open-ended set of diverse experiments taking place simultaneously.

**Nancy A. Wall:** They would see that the students learn best by participating in class and "doing science" rather than passively absorbing a lecture or watching demonstrations. I've done this with a combination of classroom participation and laboratory based activities, making use of a variety of pedagogical methods.

**From Members of the PKAL  
Faculty For the 21<sup>st</sup> Century (F21)  
Class of '96, '99, '02, & '07**

### WORDS OF WISDOM

- ◆ Give yourself time to build relationships— these programs do not happen overnight.
- ◆ Recognize that you can have great plans, but with so many stakeholders, you still might have to improvise at times.
- ◆ Have fun!



Kira Hudson Banks  
Assistant Professor of Psychology  
Illinois Wesleyan University  
F21 Class of '07



Mark M. Levandoski  
Associate Professor of Chemistry  
Grinnell College  
F21 Class of '02



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**PKAL:** *What brought you to an interest in advancing the work of transforming the undergraduate STEM learning environment?*

**Banks:** My interest began when I was involved in a similar program during graduate school. I witnessed first hand two different things:

- ♦ how rewarding it is to get beyond the ivory tower and connect with the greater community
- ♦ how teaching about research improved my own research.

**Ekey:** As an undergraduate at Dickinson College, I was exposed to activity-based learning through Workshop Physics. As a graduate student at Bryn Mawr College, I was exposed to the ideas of Peer Instruction.

As a second-year assistant professor at the University of Mary Washington, I am applying these ideas to a more traditional, non-calculus based introductory physics course. I mix traditional lecture, demonstrations, and peer-discussion.



Robert C. Ekey  
Assistant Professor of Physics  
University of Mary Washington  
F21 Class of '07

The lecture notes provided for the students contain conceptual questions and examples, which they work through independently and collaboratively during class.

**Levandoski:** There was a rich tradition of active-learning pedagogies in Chemistry as well as other departments at Grinnell when I arrived in 1999. I continue to use and build upon these practices.

In retrospect, it was fortuitous that I landed in Grinnell since I find pedagogy intellectually stimulating and challenging. Originally this might have come from my own insecurities (at the time of beginning at Grinnell having had very little teaching experience and no formal training in science education); now I am more motivated by trying to find the best ways to teach (including developing methods for measuring this), as opposed to simply finding any way that seems to work.

**McCormack:** I view the educational enterprise as one of helping people find their voice and passion— to encourage them to choose paths that are meaningful and that contribute to the lives of others. My role is to show them the field of inquiry called physics and the ways it— science in general— connects to their lives.

Whether it is from reading and discussing a text together, participating in research together, or working together in a classroom/lab discovering what it is about for me is developing a student's capabilities and supporting her interests to do something meaningful with them. I believe in that pyramid model of society: the whole benefits from and is built upon the collective of its individuals.

**Wall:** I want students to get engaged with science and recognize it as a means of gaining knowledge, not simply a repository of knowledge.

**PKAL:** *Were there risks in doing this? What were they?*

**Banks:** The risks in working with the community are too numerous to mention, so I choose not to focus on them! Seriously, sometimes keeping your eye on the bigger picture and taking it one task at a time is the better strategy for community partnerships. A few possible roadblocks are building a relationship with the schools, recruiting students in the community, and making the program a win-win or a true give-and-take.

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**Ekey:** The risks in taking this approach in the non-majors introductory class were low. There was a risk of poor teaching evaluations, which could impact my chances of attaining tenure. However, as I had observed the successes of creating an active learning environment during my own education, I knew I had a good chance of success.

I make a conscience effort in the class to explain the reasoning behind my instruction style and encourage the students to ask me questions outside of class. After three semesters of teaching this course, the students respond quite well and are able to grasp difficult concepts.

## IMPRESSIONS OF STUDENT LEARNING I

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Another risk that I had not quite expected was that students on campus might not be willing to take on the greater commitment of the program. With service-learning projects there is more pressure to be in attendance and prepared since you are not just letting your professor or classmates down when you are not present. I've found that being clear about expectations from the beginning is a must. Once I set the bar, students rise to the occasion.

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**Levandoski:** Lucky for me, there were essentially no risks to me trying these things, due to the aforementioned culture and my great, supportive colleagues. I suppose there was the risk that, in trying but failing, my teaching evaluations would have been such that I would not have been retained with tenure. However, I don't recall that I ever consciously shied away from trying new approaches or knowingly taught from a "comfort zone."

**McCormack:** In a field as small as physics and seemingly remote from human concerns, connecting the questions addressed in our field to how everyday things work and to the broad fundamental questions of what are we and where we come from is very important.

A further challenge is how to respond to the societal factors that have restricted the participation of diverse groups in physics and in science in general. Seeing students transformed and pursuing their goals is the best incentive to keep at it.

**Wall:** Sometimes students tend to want you to "give" them what they need to know if they are accustomed to more lecture-based classes. Also, you have to be willing to trade some content detail to focus on concept and process.

**PKAL:** *What connections have been of most value in pursuing these efforts, within your campus community as well as in the broader professional communities to which you belong or belonged?*

**Banks:** The community relationships have been most valuable in that I feel more connected to and a part of the community in which I work.

**Ekey:** I haven't been a physics professor for very long, so I have not had a chance to benefit from a large network of peers or the broader professional community.

As a student at Dickinson College and Bryn Mawr College, I did have the opportunity to learn different pedagogies from professors who were a part of this community. I owe my teaching style and my love of physics to them.

On campus, I have found it useful to discuss my teaching style and ideas with like-minded faculty. They provide feedback and experiences, which help improve my teaching.

**Levandoski:** I seem to be answering these questions in advance of them being asked. The support of colleagues both at Grinnell, in my department and others, as well as at other institutions has been invaluable, and continues to be.

This is true not only in general ways such as the sharing of successes and failures, but in quite specific ways, discussing teaching methods and student learning outcomes. In short, it really is all about the people.

**McCormack:** By seeking to learn about and build on what others have discovered about what works to engage and motivate students in studying the sciences, I have found allies and have been greatly supported by a community with similar goals.

It has helped me a great deal to see models that work and to have colleagues to talk with as we make sense of our efforts and find ways to improve them.



Elizabeth F. McCormack  
Professor of Physics &  
Chair of the General Faculty  
Bryn Mawr College  
F21 Class of '96

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The connections across the disciplines have been particularly valuable as a way to get out of the “group think” associated with a particular field. “Group think” can hamper the exploration and adaptation of new ideas.

**Wall:** Being at a small liberal arts college, connections are easily made with faculty, staff, and students and all are valuable, especially connections with faculty in other disciplines. In the broader community, PKAL has been a primary source of connections.

**PKAL:** *What research-based efforts have you taken to investigate the effectiveness of the student learning environment in your discipline?*

**Banks:** We take pre- and post-measures of the girls’ attitudes towards and competence in math and science (via skills assessment). We have found that the program does increase the girls’ confidence and skills in math and science.

**Ekey:** Last year, as I was creating the content for my introductory physics course, so I did not have the time to evaluate the effectiveness of my approach.



Nancy A. Wall  
Associate Dean of the Faculty &  
Associate Professor of Biology  
Lawrence University  
F21 Class of '99

This spring, I gave my students The Electric Circuits Concept Evaluation (ECCE) as a pre- and post-test to gauge their understanding of circuits.

I plan to review the results this summer, and will probably find that I need to adjust how I lead students to an understanding about circuits. I also plan to give the Force-Motion Concept Evaluation (FMCE) in the fall.

**Levandoski:** I am not entirely sure I know what this question asks, but— I am currently collaborating with colleagues at Grinnell and another school to assess learning of some traditional, core concepts in biochemistry through the use of a multi-week, research-like laboratory project.

This effort has not been to design the curriculum (which existed at both schools before we began the study), but truly to try measuring if the students learn effectively with it.

We have been gathering pre- and post-project data for about three years and intend next year and the year after to test how independent the learning outcomes are of the content by switching the project modules between the schools.

**PKAL:** *What kind of institutional culture needs to be in place to nurture careers of faculty actively seeking to integrate their research and teaching?*

**McCormack:** There are fascinating balances and tensions in education—a whole class of which can be characterized by the different scales present in a college or university. For example, institutional and individual interests can be at odds or be synergistic in any given circumstances.

A culture that tolerates and even rewards risk-taking at both the individual and institutional level is key. If institutions are to evolve themselves while meeting their missions, they must also provide a framework for continued learning at both levels— institutional and individual.

**PKAL:** *Any words of wisdom for your colleagues?*

**Banks:** Give yourself time to build relationships. These programs do not happen overnight. Recognize that you can have great plans, but with so many stakeholders, you still might have to improvise at times. Also, have fun!

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**Ekey:** There is much I still need to experience and learn. My only advice is to be willing to try and be ok with things not working out as well as you think they should.

**Levandoski:** There is a growing literature, some very good resources, on the use of alternate pedagogies— this is a good place to start, and you shouldn’t spend your time reinventing the wheel.

However, talking to colleagues about their experiences is also, if not necessary, at least quite useful; it may also be more efficient and even more fun. ■