

## PHYSICS FACULTY AND EDUCATIONAL RESEARCHERS: DIVERGENT EXPECTATIONS AS BARRIERS TO THE DIFFUSION OF INNOVATIONS

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### STRUCTURED SUMMARY

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In recent decades, educational researchers have developed substantial knowledge about the teaching and learning of Science, Technology, Engineering, and Mathematics (STEM) as well as research-proven instructional strategies and materials based on this knowledge. Yet, the majority of university-level instruction remains traditional. It is common for the lack of wide-scale reform to be attributed to faculty characteristics (e.g., faculty are interested in research, not teaching; or faculty believe that they are effective teachers and, thus, see no reason to change). While these sentiments are not completely unfounded, we were dissatisfied with the “it’s the faculty” explanation of slow reform.

To begin to better understand this problem from a different perspective, we conducted exploratory interviews with a purposeful sample of five senior physics faculty who represent highly likely users of educational research. These interviews identified two significant types of barriers: divergent expectations between faculty and educational researchers and situational constraints. This article focused on the former. Unlike situational barriers which are built into the structure of the educational system and, thus, likely very difficult to change, the barrier of divergent expectations can be changed when both groups decide to change their interactions with one-another.

There are two important participants in the instructional change process: the instructors who are interested in or being asked to change their instruction and the curriculum developers or professional development providers who provide information, materials, encouragement, etc. to help the instructors. We identified four theoretical categories of change that vary in terms of the roles of the external change agent and the instructor in the change process. Within the categories of adoption and adaptation the change agent develops materials and procedures and gives them to the instructor to implement with minimal modification. We argue that this is the way that both educational researchers and faculty view the current situation. Within the invention and reinvention categories, the instructor makes instructional changes with minimal external influence.

Analysis of the interviews indicated that all of the faculty felt they faced instructional problems that could be improved via changes in their instructional practices. These instructional problems were largely consistent with problems identified by educational research. These faculty were also aware of research-based instructional innovations that might be useful in solving these problems. However, most (70%) of their self-described instructional changes fell in the reinvention or invention categories. This means that the faculty generally agreed with education research on what the problems were and the general idea of the solutions, but did not take the complete

research-based solutions and implement them. They developed or substantially changed the principles and details of the solution.

Why would faculty engage in reinvention and invention when there is so much good research-based work readily available? During the interviews it became apparent that these faculty had problems not only with some of the results of education research, but also with the way in which research practitioners disseminated these results. Four categories emerged related to the interactions between researchers and faculty:

Category I: Educational researchers is perceived as dogmatic. The interviewed faculty tended to see educational researchers as not really interested in them or their students, but rather as promoting a particular curriculum. Faculty also criticized researchers for promoting their instructional package or technique with the expectation that they will work well in any environment, even ones quite different from the one in which it was developed.

Category II: Perception that educational research says I'm a bad teacher. The educational research community has put a great deal of effort into discrediting traditional transmissionist instructional approaches. These faculty felt that educational researchers did not respect their expertise and experience.

Category III: Educational research results and methods are questioned. Faculty identified many flaws in educational research methods that they used to justify discounting some results. The objections raised, while often true in a narrow frame, generally failed to account for the ways in which the findings have been replicated over time. While improvements can certainly be made in research methodology and in the communication of this methodology to faculty, we think it unlikely that this improved rigor will be significantly more convincing. Our contention is that faculty react to educational research emotionally as well as intellectually and that the educational research community has largely failed to acknowledge and address the emotional aspect.

Category IV: Faculty want to be part of the solution. As a result of the way that these faculty perceived their interactions with educational researchers and the research results themselves, they tended not to make full use of research-based findings. They recognized that educational research has things to offer them and that researchers have valuable expertise in teaching and learning. Yet, they did not expect an instructional package created elsewhere to work well for them. This explains why they did not follow the adoption model even in cases when they believed in the usefulness of the innovation. What most faculty described as a desirable situation was some degree of reinvention where a change agent will work with them to decide on instructional practices that fit their individual situations. This would be based on the instructors' knowledge, skills, preferences, and teaching situation as well as on the available research knowledge about teaching and learning.

We conclude that this potentially widespread mismatch between the expectations of educational researchers and traditional faculty may be an important barrier to the spread of reformed instructional practices because it leads to distrust and lack of cooperation between the two groups. Faculty and educational researchers will have to learn how to work together. This can start by the educational research community acknowledging how difficult real and sustained change can be, and identifying and articulating the factors that make such change difficult. Appropriate supportive structures can then be put in place to help faculty cope with the barriers that faculty are likely to encounter as they try to make improvements in their instruction.