

Diversity of Methods: Assessment of Quantitative and Qualitative Research Multiplier Effect

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Abstract

In his 2003 American Association for Public Opinion Research Presidential Address, Mark Schulman challenged survey researchers and noted “neither qualitative nor survey research has a monopoly on uncovering the hidden truths. They often have a multiplier effect when they are used together.” Research conducted for the Office of Research Integrity (ORI) provided the opportunity to examine Schulman’s multiplier effect. To find out how faculty view their role in training future scientists to be responsible researchers, ORI sponsored a web survey of 3,534 recipients of National Institutes of Health grants and a pilot test of in-person interviews with nine of these respondents. We compared the web survey responses with the in-person interviews to answer two research questions: (1) Are there response differences related to how faculty understand the questions and form their answers in the quantitative and qualitative experiences? and (2) What are the multiplier effects—how, if at all, is the quality of information enhanced when both qualitative and quantitative methods are used to study a topic? We did find qualitative interview multiplier effects that (1) increased survey data confidence, (2) provided illustrative examples, and (3) identified new topics of interest. By using “multiplier effect” to label this methodological approach, Schulman provides survey researchers with a succinct term that can be used to talk about research that combines qualitative and quantitative methods.

Key Words: Multi-mode; qualitative; web survey

1. Introduction

In his 2003 American Association for Public Opinion Research Presidential Address, Mark Schulman challenged survey researchers “...to move beyond our desks and our libraries and make contact with the real world,” and summarized his message noting “neither qualitative nor survey research has a monopoly on uncovering the hidden truths. They often have a multiplier effect when they are used together.”

Many survey research projects are designed to include both qualitative and quantitative methods as Schulman suggests in his comments. By using “multiplier effect” to label this methodological approach, Schulman provides survey researchers with a succinct term that can be used to talk about research that combines qualitative and quantitative methods.

Research conducted for the US Department of Health and Human Services, Office of Research Integrity (ORI) ¹gave us the opportunity to both “move beyond our desks” and to examine Schulman’s multiplier hypothesis. We will use the ORI data to compare web survey responses with in-person interviews to answer two research questions: (1) Are there response differences related to how faculty understands the questions and form their answers in the quantitative and qualitative experiences? and (2) What are the multiplier effects—how, if at all, is the quality of information enhanced when both qualitative and quantitative methods are used to study a topic?

1.1 Research Objectives

We begin with a summary of the research objectives for the ORI studies that provided the data for the methodological research followed by a description of the multiplier effect research objectives.

1.1.1 ORI Faculty Survey and Research Mentoring Dyad Pilot Study

As Schulman points out in his address, we conduct surveys “to support decision making” and “to shift our focus toward relevance and problem solving.” To provide a context for the multiplier effect contribution it is useful to know that ORI’s mission is to prevent scientific misconduct and promote research integrity, and ORI “focuses resources, not only evaluating institutional reports of research misconduct but also on preventing misconduct and promoting research integrity through deterrence and education” (Wright et al. 2008). The ORI Faculty Survey addressed the prevention of research misconduct by finding out how university faculty view their role in training future scientists to be responsible researchers and, to enhance communication on this topic, find out what faculty prefer to call this role—advisor, mentor, or something else. From October 2008 to March 2009, 3,534 recipients of 2005–2006 National Institutes of Health grants who in the last five years had primary responsibility for training at least one doctoral student responded to the web survey. (Ballou and Roff 2009)

Following the quantitative survey, we conducted the ORI Research Mentoring Dyad Pilot Study to meet ORI’s objective to learn more about faculty/student relationships and how these relationships contribute to the development of responsible researchers. From July to September 2009 we conducted nine in-person interviews with faculty members who completed the web questionnaire and agreed to a follow-up interview. (Ballou et al. 2009)

1.1.2 Multiplier Effect

To explore the multiplier effect we used the data from the two ORI studies. It should be noted that this was not an experimental design. However, having both quantitative and qualitative information from the same person on the same topics gave us the opportunity to compare the two methods among these nine faculty members. There are limitations because the in-person interviews did not focus on direct comparisons with the faculty members’ survey responses. Interviewers had a faculty recruitment profile with the faculty member’s questionnaire responses to the key questions covered in the interview protocol. However, they were instructed to not directly challenge faculty whose interview

¹The research for this article was funded by the Office of Research Integrity, Department of Health and Human Services under the direction of Dr. Sandra Titus. The use of ORI data does not imply ORI endorsement of the research methods or conclusions in this article.

response differed from their questionnaire answer. Interviewers could use the questionnaire information to decide on the extent and focus of probes used during the interview. The comparisons between the two methods are based on our interpretation. In addition, the selection of faculty for the dyad interviews was purposeful and was not designed to be representative of the quantitative research. For example, the survey found that more faculty prefer to call their role working with doctoral students advisor (54 %) than mentor (38%) or supervisor (9%). For the nine dyad interviews our goal was to interview about equal numbers of faculty who prefer to call their role working with doctoral students advisor (five) and mentor (four).

1.2 Quantitative and Qualitative Research Methods

The literature that compares quantitative and qualitative research methods tends to focus on descriptions of the attributes of each approach. To our knowledge, there is not any research that has used data to compare results obtained from each method or to systematically describe a multiplier effect. Discussions in the literature, similar to Schulman's address, remind researchers that "each method is based on different yet complimentary assumptions and each method has certain strengths that can be used to compensate for the limitations of the other." (Steckler et al. 1992) Reichart and Cook (1979) go beyond Schulman's recommendation: "Our position is stronger: complex phenomena require the application of multiple methodologies in order to properly understand or evaluate them. The issue today is not one or other but rather how they can be combined to produce more effective evaluation strategies."

For this article we use a summary of the methods that represents the discussions in the literature that compare quantitative and qualitative research. We used these distinctions of each method to guide our multiplier effect analysis and our discussion of quantitative and qualitative methods (Table 1).

Table 1: Comparison of Quantitative and Qualitative Methods

Quantitative	Qualitative
Deductive: Verification and outcome oriented	Inductive: Discovery and process oriented
Measurement tends to be objective	Measurement tends to be subjective
Reliable: Technology as instrument (the evaluator is removed from the data)	Valid: Self as instrument (the evaluator is close to the data)
Generalizable: The outsider's perspective; population oriented	Ungeneralizable: The insider's perspective; case oriented

Source: Steckler et al. 1992

Among the distinctions summarized on Table 1, the subjective characteristic identified with qualitative research was a notable challenge we encountered. The three researchers conducting the multiplier effect review had to confirm we were all using the same criteria for our analysis of the qualitative data to ensure consistency in our assessments. To guide the discussion on how and when qualitative research is used, we referred to the models on Table 2.

Table 2: Qualitative Research Models

Model	Description
A	Qualitative used initially to help develop quantitative measures
B	Qualitative used to help interpret and explain the quantitative findings
C	Quantitative used to help interpret qualitative findings
D	Qualitative and Quantitative are used equally and parallel (often to cross-validate the findings)

Source: Steckler et al. 1992

The two ORI research projects followed both Model A and Model D. As part of the questionnaire development process cognitive interviews were conducted (Model A). However, we are only using the data from the nine dyad pilot interviews (Model D) for the multiplier effect analysis. Our goal for the dyad pilot study, as in the Model D description, was to obtain additional, complimentary information to the web survey. The primary objective of the interviews was to match faculty descriptions of their relationships with reports from recently graduated doctoral students. A secondary benefit was to expand our understanding of faculty attitudes and behaviors, in particular, as related to the Responsible Conduct of Research (RCR). The qualitative information provided a rich context for the survey results.

2. Multiplier Effect Methods and Results

2.1 Overview of Methods

To conduct a multiplier effect analysis, we had to develop a research approach. Re-contacted in 2009, Schulman provided additional information about the multiplier effect:

“By multiplier effect, I meant that the insights gained from combining qualitative and quantitative are more than just the independent sum of each. They often complement each other and produce far greater insights than either one independently.”²

We decided to use the two dimensions suggested by Schulman to answer these research questions: (1) Complement: Are there response differences related to how faculty understand the questions and form their answers in the quantitative and qualitative experiences? and (2) Insights: How, if at all, is the quality of information enhanced when both qualitative and quantitative methods are used to study a topic? Each of the three members of the research team took three faculty members, generally the individuals they had conducted the in-person interview with, to do the comparisons on these two dimensions.

Among the 61 ORI Faculty Survey questionnaire items, for the multiplier analysis we decided to focus on 15 related to educating doctoral students grouped by the following ORI research themes: (1) faculty role descriptions, (2) graduate student education responsibilities, and (3) activities conducted with doctoral students. Table 3 summarizes the questionnaire items.

² November 24, 2009 email exchange with Mark Schulman.

Table 3: Research Themes of Questions Used for Multiplier Effect Analysis

Faculty Role Descriptions (Two Questions)	Primary Responsibility for Training Doctoral Student (Six Questions)	Faculty Activities with Doctoral Students (Seven Questions)
-Preferred name for faculty role <i>[Response choices: mentor, advisor, supervisor, other]</i> -Describe role <i>[Response choices: open-ended]</i>	-Responsible Conduct of Research training -Authorship policy -Set data collection standards -IRB/IACUC training -Manage cases of misconduct -Monitor Ph.D. progress <i>[Response choices: institution, faculty, other]</i>	-Discussed good research practices -Reviewed rules of working in a lab -Discussed data management -Discussed research misconduct -Interpreted student data -Reviewed data with student for publication -Assisted in preparing presentations <i>[Response choices: did with all, some, none doctoral students]</i>

2.2 Complement Dimension

To review the complement dimension for response differences related to how faculty understand the questions and form their answers in the quantitative and qualitative experiences, we compared the nine faculty members' responses to the 15 ORI Faculty Survey questions listed in Table 3 with the interview transcripts. We made a single judgment: Did the answers from each mode match or not? Table 4 provides an overview of the total number of decisions (135) and the outcome of these decisions for matches (104), non matches (20), and items that did not have interview data (11). While most comparisons were clear, all three members of the research team reviewed the non matches to finalize the classifications.

Table 4: Multiplier Effect: Complement
(Total Number of Questions Matched for Nine Cases)

	Faculty Role Descriptions	Primary Responsibility for Doctoral Student Education	Faculty Activities with Doctoral Students	Total
Total possible	18	54	63	135
Match	17	37	50	104
Non match	1	9	10	20
Not in interview	0	8	3	11

The following examples illustrate what we classified as a non match.

Primary responsibility for doctoral student education. Among the six questionnaire items described on Table 3 related to who has primary responsibility for doctoral student education we identified nine where the information from the web survey did not match the in-person interview. Here are two examples:

Web-survey response: **Faculty** is responsible for Responsible Conduct of Research training

In-person interview: Faculty does not directly train students in RCR. There is an annual institutional training students are required to attend. Faculty comment: “so it’s sort of like that’s taken out of our hands”

Web-survey response: **Institution** is responsible to set standards for data collection

In-person interview: Faculty talked about how his lab managers set the standards. Faculty comment: “they [lab managers] provide a tremendous fund of knowledge, contemporary and historical, stability, and really set the tone for how we do things and what sort of hour-by-hour, day-to-day expectations are.”

Faculty activities with doctoral students. For the seven questionnaire items related to faculty activities with doctoral students, we identified ten where the information from the web survey did not match the in-person interview. The main reason for the non matches are the faculty questionnaire responses “all, some, or none” of their doctoral students having experiences such as discussing research practices and other activities listed on Table 3. In contrast, the faculty interviews included conversations about how doctoral students experience these activities. The interviews provided cognitive information on how faculty made the response-choice decision to select the “all, some, or none” response and why selecting a response could have been challenging. We learned that although the faculty member may define himself or herself as having the ultimate responsibility for each of his or her doctoral students, the reality is that, depending on the academic institution or the specific type of training activity, the actual training may be delegated.

Example:

Web-survey response: Discussed research misconduct policy with some students

In-person interview: Faculty member reports all students are taking an ethics course
Faculty comment: “pretty sure they can [recognizing scientific misconduct] ...because they’re getting that training in the ethics course.”

2.3 Insight Dimension

Developing an approach to review the 15 items for the multiplier effect insight dimension was more challenging compared to the complement dimension. To find out what, if any, insights from the interviews enhanced the quality of information for ORI we wanted to provide more information than just deciding if there was or was not an insight. To do this we developed a description of three types of insights: Type 1: Provides a context for quantitative results; expands our understanding of how faculty interpreted the relevant questionnaire items; Type 2: New information about the survey research questions that would not have been known without the interview; Type 3: Possible new topic area for ORI to consider. The topic was not on the questionnaire or included in the interview protocol, but is relevant to ORI’s mission.

The insight dimension was more challenging to assess because we used multiple criteria and there was not always a direct comparison with a survey question. In some cases it was not a single quote or response to one topic in the interview that resulted in an insight, but the overall conversation. Also, Type 3 insights were new, unexpected information. These insights were not the result of a research question addressed in either the web survey or the interview protocol; it was information initiated by faculty during the interview.

To quantify the extent of the insight review effort, Table 5 provides an overview of the total number of decisions that could be made. Each of the 15 items was assessed for each of the 3 types of insights among the nine interviews resulting in 405 possible decisions. The process for decisions about insights mirrored the complement approach with each member of the research team doing an initial review followed by a team discussion and a final decision. Table 5 shows that there were more Type 1 insights (43) than Type 2 (15) or Type 3 (5). This distribution is generally what was expected since the qualitative interviews were focused on obtaining information that was parallel to the web-survey results.

Table 5: Multiplier Effect: Insights
(Total Number of Questions by Type of Insight for Nine Cases)

	Faculty Role Descriptions	Primary Responsibility for Doctoral Student Education	Faculty Activities with Doctoral Students	Total
Total possible	54	162	189	405
Type 1: gives context;expands understanding	8	17	18	43
Type 2:new relevant information	2	8	5	15
Type 3:related, but new topic area	1	0	4	5

Type 1 Insight: Provides a context for quantitative results; expands our understanding of how faculty interpreted the relevant questionnaire items

When we were developing the questionnaire for the ORI Faculty Survey there were topics ORI was interested in that are difficult or not possible to measure quantitatively. For example, using individual indicators in a questionnaire to measure faculty/doctoral student relationships misses the dynamic described in the interviews of how these components fit together to achieve the scientific training objective our client wanted to understand. Below are several examples of how the interviews furthered our understanding of the data from the survey.

Faculty role descriptions. One of the main ORI objectives for the web survey was to learn how faculty view their role in training doctoral students and, to improve communications related to the responsible conduct of research, to find out the title they prefer for this

responsibility. The survey results showed more faculty prefer to be called advisor (53%), then mentor (38%), or supervisor (9%). The interviews gave us insights on how complex these roles are and how faculty describe particular situations that relate to their role description.

“We don’t play a dominant role in making sure that each of the milestones are reached. So in that sense, I don’t consider myself an advisor, whereas perhaps for a master’s student, where I do take a much more hands-on role in defining their academic program, and nudging them along to make sure that they’re meeting all of their requirements. But to me advisor has a bit more of a bureaucratic connotation. When I use the word mentor, I’m trying to teach them the life skills of how to be a successful scientist and it’s a lot more than just making sure that they pass their qualifying exams, and did this little task and that little task.”

Faculty/Doctoral student relationships. ORI wanted to find out what there is about a faculty/doctoral student relationship that is more or less likely to result in training responsible researchers. The survey focus was on the faculty member. In the interviews we learned more about how faculty perceive the role of the doctoral student in the development of the relationship.

“I mean clearly the students who have been the most successful with me, and let’s see what the future ultimately defines, are those that I guess have enough personality that they’re willing to push back. I like to challenge my students. Some sort of just take it and say, “Okay,” and they go off and do it, and others will argue with me, say, “Well, how about this way, not that way?” and they come to me with some literature and say, “Oh, I was reading this paper. We need to think about it in the context of what we’ve been talking about.” So they’re more interactive with me and I, I guess in turn, more interactive with them. But I don’t, you know, that’s nothing that I’ve imparted in particular. It’s, again, their own character and just their passion for the science that makes the communication easier, and more effective and probably a bit more abundant. So it’s easier to work with that type of individual obviously, who comes in all the time all excited, having really processed, and thought and is a partner in the process, where others are more passive and you needing to sort of provide the energy, as well as perhaps some of the intellectual direction. That can become draining.”

Faculty/Doctoral student activities On the questionnaire, we measured faculty/doctoral student activities by finding out if “all, some, or none” of the faculty members’ doctoral students had 17 experience. The in-person interviews really expanded on this information. For example, in the questionnaire faculty had to decide on a single response to summarize activities with students. During the interviews we learned that in some cases the questionnaire response choice described what faculty directly experienced with the doctoral student. In other cases, the response also included activities they were responsible for, but the doctoral student experienced by working with someone else. The in-person interviews provided insights on the extent doctoral student education is delegated and who it is delegated to such as lab managers, post-graduates, graduate program directors, and institutional review boards. As a result of this insight, ORI is now aware of others who work with doctoral students and play a substantial role in educating them to be successful scientists. The following is an example of how one faculty member describes delegation:

‘I rely on their immediate mentors, as they’re learning those techniques, to also provide some oversight and usually that comes from within the lab. We have a pretty broad skill set amongst our people. So my two, they’re both named Pat – one Patricia and one Patrick – they’ve been working with a lot of students over the years. They have pretty good antennae for quality control and when a student is doing well or when a student is struggling a little bit, in terms of just trying to master a technology. Obviously I’ve got post-docs and other senior fellows, who provide other outlets, to provide experience and conversation and oversight. So I’m crosschecking a fair bit with different eyes and ears, in terms of how things are going, as well as having direct conversations with my students to get a sense of where they’re going.’

‘My first couple of students, I was working in the lab right next to them. We were talking and working together all the time. It was a very different dynamic. Now I don’t have the time nor the skills to do the science in the lab, so I work in different ways.’

Faculty view of institutional role. The in-person interviews provided descriptions of the range of relationships faculty have with their institutions related to doctoral student training, and faculty perceptions of when he or she assumes the institution is handling RCR education. During the in-person interviews we learned about RCR activities faculty members have handed off to their academic institution³ and, therefore, may not even know what their doctoral student is being taught. This suggests a possible gap in doctoral student training that was not notable from the web-survey results, and offers ORI insights on the likelihood that faculty will train or reinforce the training done by other entities when they may not know what RCR instruction doctoral students receive.

‘So there’s actually a formal class here that it’s part of the training grant, NIH training grant requirements. I don’t know how good a class it is.’

‘We have departmental expectations, milestones and so forth. So, again, let’s talk from the context of a PhD student. The PhD student will be admitted by the department, but into an academic division, largely based on the interests of the students and the funding streams that are going to support that student. Each of our divisions has its own mentorship program, journal clubs, seminars, faculty meetings to sort of support the academic mission. They’re on core curriculum, of course, as their qualifying exams, one and two years into the program and the like. So at the division level, there’s a lot of cohesiveness and interaction. In addition, at the department level there are a couple of core courses which are required by all doctoral students in the department. So all of the incoming students will share a couple of courses over the year. There’s a monthly departmental seminar that’s required of our students. And then what’s been very helpful is there’s a very active student organization that not only enriches the science by creating their own seminar program – maybe once a quarter or something like that they’ll take the initiative to bring somebody in.’

³ It should be noted that we use the term “academic institution” to summarize the multiple sources of doctoral student training that faculty are not directly involved with. It may be the central administration of a university, but even with nine interviews it was evident that there is not one single model across institutions for providing RCR training. Depending on the university, doctoral student training could also be the responsibility of an academic program, a department, or other entities within the university.

Type 2: New information about the survey research questions that would not have been known without the interview

The multiplier effect provided insights on some important topic areas that we would not have known about if we had only conducted the web survey.

Laboratory meetings. The web survey only had one item related to faculty and doctoral student lab experience. Faculty were asked if he or she had reviewed with all, some, or none of the students who received their doctorates in the last five years student the rules of working in a lab. All of the in-person interviews with faculty who had laboratories, highlighted this activity as the most important doctoral student training experience. It is typically the weekly lab meeting where faculty get across their messages about RCR and about how doctoral students can learn to be scientists. Without the in-person interviews we would not have known about the faculty/doctoral student lab meeting interaction and how critical these meetings are to developing responsible scientific researchers. Here is how one faculty member described what happens in his lab meetings:

“We have formal lab meetings once a week, where students and fellows sometimes may present, and there we lay things out in a pretty sort of detailed discussion and they’re – I don’t know what the right adjective is for them, but they’re – we don’t pull our punches. We just have frank conversations and we challenge in a friendly but forceful way what people are doing and what people are thinking, arguing that critiques amongst your friends is a lot better than getting bashed in some more public type of setting. And then depending upon the particular aspects of the science, as graduate students they’re presumably learning new techniques or new approaches.”

Challenges of identifying research misconduct. The web questionnaire had two items related to research misconduct. One asked faculty if they had “discussed research misconduct policies” with their doctoral students who had graduated in the last five years (59% reported doing this with all). The other question asked faculty who had primary responsibility to “provide training in identifying research misconduct”—the institution (57%), faculty (40%), or some other entity (3%). The insights from the in-person interviews underscored the challenges faculty encounter related to scientific misconduct. The interviews suggest that misconduct can be a “gray area”—not a clear “black and white” distinction. Another challenge is distinguishing between misconduct and mistakes which might be expected from doctoral students. In all of the nine interviews faculty described some type of actual or potential scientific misconduct they had experienced. These insights about how uncertainty can foster indecision about addressing misconduct provides ORI with information about barriers to reporting misconduct and topics that need to be included in RCR training to give both faculty and students the tools needed to identify scientific misconduct. The following example from the in-person interviews illustrates how faculty perceive doctoral training and experiences related to misconduct.

“But sometimes you just, you know, when are you changing; and there are things that are sort of right on the line. Like I could say to someone, “I would never do that. I think that’s wrong.” Well, you know, that could be pretty sanctimonious of me, too. It may not be ask bad as you think it is. Different people can honestly disagree on the line. But one of the important things is to make sure your student is telling you .”

Type 3: Possible new topic area for ORI to consider

In addition to obtaining insights related to the research objectives for both the ORI Faculty Survey and the Research Mentoring Dyad Pilot Study, the in-person interviews also provided insights on new topics, not included in these objectives, that relate to ORI's mission. It should be noted that these topics originated with faculty and were not included on the in-person interview protocol.

Non-USA faculty/students and the ethical conduct of research. Faculty brought up their concerns related to working with students, as well as other faculty, who come from other countries and cultures.⁴ The following illustrate faculty perspectives on this aspect of developing responsible scientists in this country.

“She’s on probation for her entire time here. I’m actually on her thesis committee. She’s a very good student. She is from China. I think one of the things that we have to be really careful about is there are different standards of behavior, and I don’t want to generalize about people, but what I’ve been told is that the Chinese, it’s sort of a sign, a mark of reverence to plagiarize from somebody. You have to make sure your student; you know, it’s not to say that Americans are more honest in any way than people from different, other cultures, but the norms can be different and there are certain things that you just take for granted.”

“They want a technician to hand them data, and I think that’s something the NIH really has to look at. Right now the NIH are opening a lot of Visas to bring in foreign students. I don’t know why they’re doing that. If they believe that; I don’t know what they believe in. But what they’re doing, they’re killing, they’re getting Americans steering away from doing a PhD and becoming scientists, because the American students are telling me, “What’s the point of going forward?” that they’d rather hire a foreign post-doc. And interestingly, what the American students are telling me, because they will not do unethical thing and the foreign post-docs will do unethical thing that they will not do.”

Increased complexity of university organizations. While the cognitive interviews used in the questionnaire development phase of the ORI Faculty Survey suggested that universities are increasingly more complex, the in-person interviews provided insights on how this increased complexity can impact RCR training. The faculty description that follows illustrates how faculty work with multiple entities in the university that may have similar or different doctoral educational guidelines.

“Then I’m a member of training programs in three different departments in the University. My primary appointment is here in the Department of Environmental Health Sciences in the School of Public Health, where in the past I’ve served as Director of the Division of Toxicology and had a primary responsibility for the educational programs of our PhD students. I’m also a member of the training program in the Department of Pharmacology and Molecular Sciences over in the School of Medicine, and I’m also part

⁴ To provide a perspective on the extent of non-USA faculty, 30 % in the ORI Faculty Survey reported they were not born in the USA.

of the training faculty for the Department of Biochemistry and Molecular Biology, which is also here in the School of Public Health.”

Role of academic/scientific culture. While the ORI Faculty questionnaire identified faculty members’ perceptions of their role in doctoral training and the actual activities they engage in with doctoral students, there was not any item that addressed the norms or cultural context within which doctoral student training occurs. The insights from the in-person interviews suggest that ethical scientific research is “assumed” and, therefore, faculty does not focus on RCR training. For ORI this insight can be valuable because it suggests a need to be deliberate in making sure faculty explicitly incorporate ethical training into their doctoral programs. Here is an example of how one faculty member describes his assumption about ethical scientific behavior:

“Certainly, I came up through the system where there was very little discussion of what is responsible conduct in research. What is appropriate ethical behavior. And I suspect that a bunch of my colleagues who don’t think about it. They sort of assume oh, I’ve got this inner compass. I know what’s right. But I’m not sure they’ve ever had any formal training themselves, and that’s probably something will, by itself, go away because now all of our students coming through are getting that training. But maybe it’s something that the institution should be more careful about.”

3. Summary and Observations

Mark Schulman introduced the term “multiplier effect” to succinctly describe research that uses both quantitative and qualitative methods to assist our clients by “uncovering hidden truths.” To the best of our knowledge, this is the only empirical study comparing both methods to address a clients overall research objectives, and the first to develop a methodology to make the comparison.

3.1 Summary

Overall, the research confirms that there is a multiplier effect when both quantitative and qualitative methods are used. Our method was to operationalize “multiplier effect” by defining complement and insight dimensions. Then, to determine if there was a multiplier effect, we compared a respondent’s quantitative and qualitative responses using these two dimensions.

The goal for the complement dimension analysis was to have an objective review of the match between the two types of data. The value of the multiplier effect on this dimension is finding out when, or if, the qualitative data substantiate the survey results. Topic areas where the data from the two methods confirmed information increased confidence in the survey results and give our client additional evidence to move forward on related decisions.

The insight dimension, while more subjective, was more comprehensive and provided added value in three ways: (1) context for the quantitative results and expanded understanding of how faculty interpreted the relevant questionnaire items; (2) new information about the survey research questions that would not have been known without the interview; and (3) related new topic area for the client to consider.

In his presidential message, Mark Schulman suggests the bottom line is having the research we conduct support our client's decision making and provide actionable results (Schulman 2003). The multiplier effect achieved this objective for our ORI client who pointed out that the qualitative responses are actually stronger than the quantitative ones because they can be in words that a person uses rather than the researchers words. In addition, insights from the research identified a need for ORI to clarify the role of faculty and the university in providing doctoral training. The intent of having universities responsible for RCR training was not to take it away from faculty, but to assure it was part of doctoral training.

3.2 Suggestions for Future Research

This multiplier effect research is a first step in developing a methodology that systematically incorporates quantitative and qualitative research in a research design. Our results suggest there is a multiplier effect that is measureable by the two dimensions we used, and using the multiplier methodology benefits researchers and their clients. The limitations to this study need to be addressed in future research. A replication of the complement and insight dimension analysis would assist in confirming if these, or other, concepts produce the best multiplier effect documentation. An experimental design with additional qualitative cases to compare with survey results should be conducted. And, we need to develop a multiplier effect body of knowledge to advance this methodology and illustrate the return on investment for our clients. Going forward, using the multiplier effect will focus research on "tests of real-world significance and impact" (Schulman 2003).

Note: Additional information is available from the author such as: (1) a comparison of the web- survey questionnaire items faculty answered and the interview protocol to illustrate how the topic areas of interest were covered in each method; (2) the faculty recruitment profile which gave interviewers the questionnaire responses to the key questions covered in the interview; and (3) profile of faculty characteristics for the ORI Faculty Survey and the ORI Research Mentoring Dyad Pilot Study.

REFERENCES

- Ballou, Janice, and Brian Roff. "Training Ph.D.s: The Views of Faculty on Their Role and Their Institutions' Role in Promoting the Development of Responsible Researchers." Princeton, NJ: Mathematica Policy Research, 2009.
- Ballou, Janice, Brian Roff, and Matthew Anderson, "Research Mentoring Dyad: Views of Faculty Advisors/Mentors and Their Ph.D. Students on Training/Learning to be a Responsible Researcher Pilot Study Results." Princeton, NJ: Mathematica Policy Research, 2009.
- Reichart C.S. and TD Cook. Beyond Qualitative Versus Quantitative Methods. In T.D. Cook and C.S. Reichardt (eds): *Qualitative and Quantitative Methods in Evaluation Research*. Beverly Hills, CA, Sage, 1979.
- Steckler, Allan, Kenneth R. McLeroy, Robert M. Goodman, Sheryl T. Bird, and Lauri McCormick. "Toward integrating Qualitative and Quantitative Methods: An Introduction." *Health Education Quarterly*. Vol.19(1),1992 pp.1-8.

Schulman, Mark A. "Presidential Address: Toward a New Research Relevancy: Winning Our Seat at the Table." *Public Opinion Quarterly*, vol. 67, 2003, pp.449-459.

Wright, David E., Sandra L. Titus, and Jered Cornelison. "Mentoring and Research Misconduct: An Analysis of Research Mentoring in Closed ORI Cases." *Science and Engineering Ethics*, vol. 14, no. 3, 2008, pp. 323-336.