

Matrix Surveys: A New Tool for Improving Online Learning

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Abstract: Matrix surveys open up new frontiers for gathering feedback about online and hybrid learning programs. When using a matrix survey, for example, students in each class can receive response forms tailored for that class: only questions that matter for that course, and worded in ways most likely to be unambiguous for students in that course. By providing a platform allowing different authors (stakeholders) to collaborate in reaching students (or faculty), matrix surveys can also reduce the burden and costs of surveys, while increasing response rates. The great promise of matrix surveys, however, lies in the ability to study innovations and activities that take on different forms across the curriculum.

For answering certain questions about online or hybrid learning, ask the students. For example, students can provide ‘best evidence’ about their own perceptions (and misconceptions) of what’s going on in the course, about their own behavior, and about their own ideas for improving the course, degree program and support services.

Feedback forms (surveys) have become a widely-used tool for gathering such student feedback.

With a traditional feedback form, members of the pool of respondents are each given the same group of questions, worded the same way. (see Figure 1)

But in a *matrix survey*, the personal characteristics of respondents can predetermine which questions they each see and how their response forms are worded. Today, the most familiar example of a matrix survey is a statewide primary election; voters see different sets of candidates and ballot questions, depending on their addresses and political party registration. In Figure 2, an “X” in a cell means that the group of voters in that row will see the candidates or ballot questions in that column. In the figure, each row represents a *respondent pool* and each column represents a *question group* (one or more questions that always either appear together on a response form, or else not at all. In matrix surveys, a respondent pool might consist of a single person, or many. A question group might consist of a single question, or many.

Advantages of Matrix Surveys

A statewide primary election is really a set of different elections, a few statewide, most more local. All the organizations that need to reach some set of voters in the state collaborate in running a single matrix ‘survey.’ By collaborating, these various organizations:

1. Reduce the number of surveys (elections) from dozens or hundreds to just one;
2. Reduce the total questions directed at each respondent (in those cases where two or more agents might need the same data);
3. Reduce the costs of running each ‘survey’ (election), and
4. Collaborate to increase response rates (get voters to the polls)

All of this is appealing. But it misses the potentially transformative nature of this new research tool. **Matrix surveys enable investigators to ask more pointed, less ambiguous questions.**

Consider a midcourse survey sent out to all students taking any of 500 courses taught in online or hybrid formats at your institution. A traditional feedback form might include a question like this, asked of all those students:

- “How much is the learning approach taken in this class helping your learning?” (no help....great help)

What’s a ‘learning approach?’ Will all students interpret the phrase the same way? And once the instructor, and the program leader, have the data, how does the data guide them to improve the program?

In contrast, a matrix survey might include (for students in just 7 of those 500 courses), a question like this, written by library staff and chosen in advance by the instructor:

- Think about the recent assignment involving use the JSTOR database. To what extent do you agree or disagree with these statements about your experience using JSTOR,
 - “I had trouble finding the full text of articles.”
 - “In addition to the JSTOR materials I needed for the assignment, I also browsed JSTOR and found some valuable additional material.”

Another dozen classes might have gotten identical questions, except that the names of other library databases appeared instead of “JSTOR”, allowing librarians and faculty to get feedback for each course, for each database, and also to pool responses to gauge how well library services were matching up to student and faculty needs.

In this ability to support laser precision in questions, matrix surveys are a little like surveys with conditional questions (e.g., ‘skip patterns’ or branching). With conditional questions, the respondent’s early answers dictate which questions they see later on. In contrast, a matrix survey uses available data about respondents to determine in advance which questions are sent to each person. Conditional questions work best if only a few screening questions are needed and if respondents can be trusted to answer those screening questions accurately.¹

To explore how matrix surveys open new options for evaluation, assessment and research about online learning, we have been experimenting with Flashlight Online 2.0, a new survey system powered by the Skylight Matrix Survey engine. Skylight has been developed by the Washington State University’s Center for Teaching, Learning, and Technology (CTLT) working in collaboration with The TLT Group. About 90 institutionsⁱⁱ already have site licenses for Flashlight Online 2.0. Major funding for the work was provided by the Fund for the Improvement of Postsecondary Education (FIPSE) of the US Department of Education.

We originally developed our concept of matrix surveys to provide a platform for a new approach to student course evaluation. (More on this below.) As we have begun using Flashlight Online 2.0, however, we have begun to realize that matrix surveys can be used to carry out strikingly powerful, pointed kinds of inquiry in many areas of assessment and evaluation. The next section of this paper summarizes several of these applications before turning to specific ideas for online learning:

1. Evaluating workshops and courses;
2. Scholarship of teaching and learning (e.g., Improving information literacy)
3. Support of Innovation: Guiding ePortfolio initiatives;

1. Evaluating workshops and courses; scholarship of teaching and learning

Raymond Pina and his colleagues at California State University, Sacramento were the first to use matrix surveys to gather feedback about workshops. In their first round, the questions for participants in each workshop were identical, but the response forms each included the name of that particular workshop, automatically. Data could be analyzed for separate workshops (respondent pools) or across workshops. Workshops were offered, and data was being gathered, over many months. Despite the differences in survey wording and in timing, all of this was a single survey, and data received from all workshops offered to date could be analyzed at any time.ⁱⁱⁱ

At Washington State University, the engine is being used in a more ambitious way to gather feedback from over 1000 courses each term, tailoring the questions to the courses. For example, feedback forms are tailored by:

- Whether a chemistry course includes a lab and requires questions on that topic
- Whether a course includes a teaching assistant, about whom feedback is being gathered;

Matrix surveys for course evaluation can take advantage of another feature of matrix surveys: *pluralistic authoring*. Different stakeholders could piggyback on the form to ask their questions of some, or all, students:

- The Writing Program can add specific questions that would be asked only of students registered for courses flagged in the catalogue as "writing intensive".
- The Technology Services unit could ask some questions about a feature of the course management system only of students in courses that had used that feature.
- The Disabilities service could add questions about services for a disability, questions that are seen only by those students who have that particular disability.

Flashlight Online also makes it possible to create reports on courses, or sets of courses, or issues, each tailored to the needs of that stakeholder.

2. The Scholarship of Teaching and Learning; Example of information literacy

By "Scholarship of Teaching and Learning" (SoTL) we mean inquiry carried out by instructors about their own students in ways that are intended to improve those courses and also indirectly to inform their colleagues (e.g., through findings, sharing of research methods).

Matrix surveys provide a flexible, powerful tool for faculty, working alone or in faculty learning communities, to gather feedback during the term. And Flashlight Online brings another benefit to SoTL: Washington State University this web-based system so that any author can make surveys and data visible to any other authors at any other institutions that also use Flashlight Online. The system has been designed for the needs of scholarship, making it easy for authors to build on one another's work.

The prototype for SoTL on the companion web pageⁱⁱⁱ focuses on information literacy, and includes two sample response forms created with the same matrix survey, as well as a sample faculty form that faculty could use to create such response forms for their students, course by course.

Matrix surveys can make it easier for academic staff engaged in SoTL to:

- a) create tailored surveys for each course or workshop they teach, without having to create questions on their own each time; instead they can work with colleagues and staff as a community of practice, sharing the work of developing feedback questions appropriate for each issue. Each time a member of this community needs to develop a student survey or feedback form, he or she can select from the question groups developed by the community.

- b) Follow trends. If an individual faculty member uses the same matrix survey over a period of years to study activities (e.g., how students interact online), it becomes possible to see whether progress is being made in teaching and learning.
- c) Pool data. As we will see in the discussion of information literacy below, phenomena that might not be visible if a question is only asked of, say, 15 students in one class may become much more obvious if 10 faculty pool their data to create a bigger sample.

3. Guiding Innovation: Examples of ePortfolios, Student Response Systems

Matrix surveys provide even more power when monitoring and guiding innovation. That's because innovative ideas, technologies and resources are almost always implemented differently by different faculty. So their students can't all be asked the same questions. In fact, **the more empowering the innovation, the more likely that it will be used differently by different faculty**. Thus, questions that might be on target for one course could be irrelevant or even incomprehensible to faculty or students who used the innovation differently.

Our matrix surveys focus on activities: what people actually *do* with the new technology or teaching idea. The ePortfolio matrix survey is organized around over a dozen activities that are each sometimes supported by ePortfolios. Items have been developed for each activity.

The matrix survey also provides the ability to tailor the wording of such questions, which can be crucial for emergent innovations. Innovations are often called by different names in different courses, especially when technology is in play. Many kinds of software are used for ePortfolios; in many courses, the activity is referred to by the name of the software used to carry it out (e.g., TaskStream, iWebfolio). The instructor can both indicate which activities require feedback, and which term should be used throughout the survey to designate the ePortfolio.

The rising popularity of using clickers for student polling suggests another target for matrix surveys. Here too rapture of the technology often diverts people's attention from the activity to the hardware. Most people's attention has focused on one particular technology for polling: handheld consoles called "clickers." But many other technologies can be used to support similar teaching/learning activities: cell phones, holding up colored cards and, if students are online, the polling modules built into some online conferencing systems.

Even more important, "polling" can support several different instructional activities (taking roll, peer instruction, instant quizzes, incentives for students to pay attention, ...) each of which has different implications for learning.

The matrix survey gives us flexibility to ask students in each course only about (a) the particular technology used for polling in that class, and (b) the particular educational activities supported by polling in that course. Then the data can be analyzed not only course by course, but also activity by activity, and technology by technology.

Applying Matrix Surveys to Online and Hybrid Courses and Programs^{iv}

Now let's look at the potential of matrix surveys for providing guidance for improving online learning. We begin with several working assumptions.

First, **engage stakeholders** who could benefit from the resulting data, and involve them, as a team or as relatively independent authors, in creating question groups for the matrix survey. Remember that each question group can be targeted at defined subsets of students (e.g.,

Representatives from the following stakeholder groups could create question groups for the matrix survey:

1. Faculty teaching the courses
2. Administrators of the online program
3. Department heads
4. Information technology administrators or support staff
5. Vendors who provide technology used in the program
6. Librarians
7. Representatives of employers who often hire graduates
8. Staff concerned with equal opportunity
9. Staff concerned with disabilities
10. Last but not least, students. They too are users of the information gathered through these feedback forms.

Staff who are responsible for the matrix survey as a whole need to monitor the length of response forms. Authoring by multiple stakeholders have a complex impact on response rates:

Factors that could increase response rates	Factors that could decrease response rates
<ul style="list-style-type: none"> • Targeted questions with clear potential for program improvement (so that response is empowering for students) • Stakeholder efforts, separately and together, to publicize the importance of response • Fewer discrete surveys, lessening ‘survey burden’ on students • Fewer total questions, since each author need not ask duplicate questions 	<ul style="list-style-type: none"> • Response forms may become so long respondents delay responding, or abandon before completion

Second, to understand and improve outcomes, **ask students about teaching/learning activities**. For example, Chickering and Gamson (1987) summarized seven dimensions of student activity that usually affect outcomes:

1. Good Practice Encourages Student Instructor Contact
2. Good Practice Encourages Cooperation Among Students
3. Good Practice Encourages Active Learning
4. Good Practice Gives Prompt Feedback
5. Good Practice Emphasizes Time on Task
6. Good Practice Communicates High Expectations
7. Good Practice Respects Diverse Talents and Ways of Learning

These activities are likely to affect retention as well.

Chickering and Gamson’s categories are too conceptual and broad to directly suggest questions for a matrix survey. But they do provide an initial framework for developing a menu of activities for each principle.

Suppose an institution wanted to empower faculty to create tailored student response forms for feedback every week or two. To create a feedback form for a course, interested faculty could access an online menu that asks, principle by principle, about activities in that course.

For example, under the heading “Good Practice Encourages Cooperation Among Students,” instructors might see specific teaching/learning activities such as:

- Group Projects and Assignments
- Peer Editing of Individual Assignments
- Seminar-style discussion online
- Encouraging informal social contact among online students
- Practicing a foreign language by writing (conversing) online with native speakers
- (etc.)

When choosing such an activity, the instructor might also be prompted to provide a bit of additional information. For example, for the “group projects and assignments,” the instructor might be asked to provide the name of the assignment, which would then be integrated into the wording of the questions seen by the students in that course.

Each of these activities might offer options for formative and for summative question groups for students.

- A formative question could ask students about barriers that hindered or prevented them from working on the assignment (e.g., felt poorly prepared to do it; instructions unclear; lack of access to needed equipment at times when they could study; etc.)
- A summative question about the same assignment might ask the student to describe the most important value or skill they’d learned, and to estimate the value of that learning to their future careers (great value – waste of time)

The instructor could select one or two activities, marking ‘formative,’ ‘summative’ or both. The form might suggest that instructors limit their choices to, say, five question groups. (That number might vary according to how many other stakeholders are also contributing questions to the same feedback form.)

The instructors’ requests for the week could be uploaded to the matrix survey, producing a batch of student response forms, each tailored for a particular class, including both the instructor’s questions and any relevant questions from other stakeholders.

Conclusion: Using Matrix Surveys for Online Learning

Matrix surveys can be applied to research in almost any discipline. But their potential for guiding the rapidly expanding, turbulent field of online and hybrid learning is especially provocative.

To summarize, matrix surveys provide a number of transformative advantages for evaluating and improving online learning:

1. The questions can focus on activities, and the roles that technology plays in supporting or interfering with those activities, in terms that students will understand. This activity-focused feedback can yield feedback of practical use to faculty and administrators for program improvement. That laser precision of matrix surveys comes both from the ability to target particular questions to particular courses, and also the ability to tailor the text, respondent by respondent if need be.
2. Different stakeholders can collaborate in developing questions. Each group of questions might be targeted to only a small subset of the total number of students. By collaborating the number of

surveys and survey questions can be reduced, the cost of surveys can be reduced, and the response rates can be increased.

3. Because each question is likely to be asked in a number of different courses, data can be pooled, or contrasted, across courses.
4. Authors can collaborate, and build on another’s work, within and across institutions. For example, this strategy for gathering data to guide development of online learning could be used by a consortium of institutions. Over time, faculty ideas for questions (upgrading existing questions, adding new ones) could add to the system’s flexibility and comprehensiveness. Faculty could also draw on the data for their own scholarship of teaching and learning.

The examples described in this paper can only hint at the transformative impact of this kind of research tool.

About the Author

Stephen C. Ehrmann is founding Director of the Flashlight Program for the Study and Improvement of Educational Uses of Technology. Flashlight is a program of the non-profit Teaching, Learning and Technology Group (The TLT Group) where Dr. Ehrmann serves as vice president.

Figures

Figure 1: Traditional Survey

	Question Group
Respondent pool	<ul style="list-style-type: none"> • Question 1 • Question 2 • (etc.)

Figure 2: Primary Election (Matrix Survey)

	Question Group 1: Party A candidates for position 1	Question Group 2: Party B candidates for position 1	Question Group 3: Ballot question for District 1	Question Group 4: Party A candidates for position 2	...	Question Group N
Respondent pool 1: Voters in Party A, District 1	X		X	X		
Respondent pool 2: Voters in Party B, District 1		X	X			
Respondent pool 3: Voters in Party A, District 2	X			X		
Respondent pool 4: Voters in Party B, District 2		X				
...						
Respondent Pool M						

ⁱ Conditional questions require that all respondents understand the earlier questions. For example, if one were doing a survey of many students in online courses and wanted to ask some of those students about Elluminate, all of the students would need to understand the early question, “Do any of your courses use Elluminate?” With a matrix survey, only students whose courses used that technology would receive the questions about its use. Flashlight Online 2.0, the matrix survey system used in this article, will ultimately include conditional questions.

ⁱⁱ To see if your institution is among those with access to Flashlight Online 2.0, see <http://tinyurl.com/66b244>. For information about subscriptions, see <http://tinyurl.com/5qkvm2>.

ⁱⁱⁱ Examples of all the matrix surveys cited in this article can be found at <http://tinyurl.com/clemmj>.

^{iv} The plan described in this section was developed with support from Drexel University. At this writing, Drexel is considering developing such a system for using student feedback to help improve online learning.