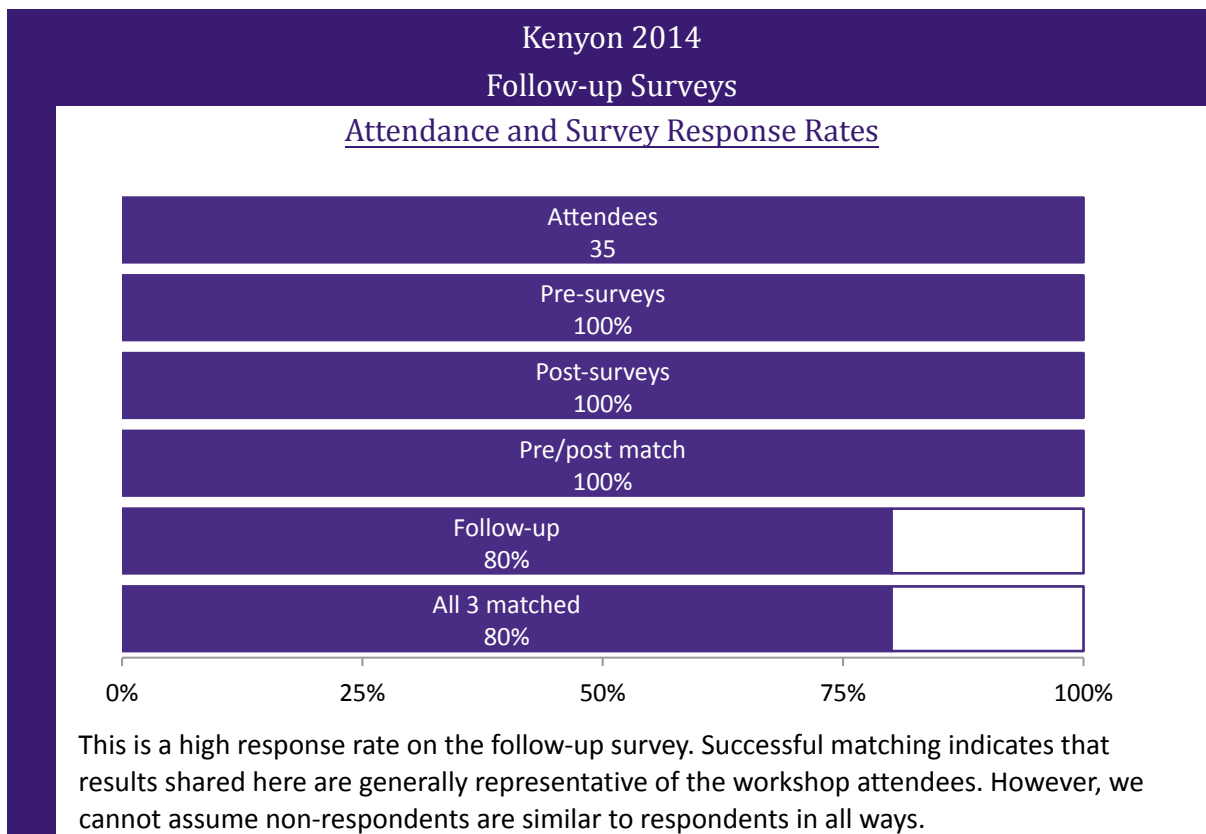# Collaborative Research: Supporting Pedagogical Innovation for a Generation of Transformation via Inquiry-Based Learning in Mathematics (SPIGOT)

Follow-Up Report 2: 2014 Workshops (#2 & #3)
February 2016

Charles Hayward and Sandra Laursen
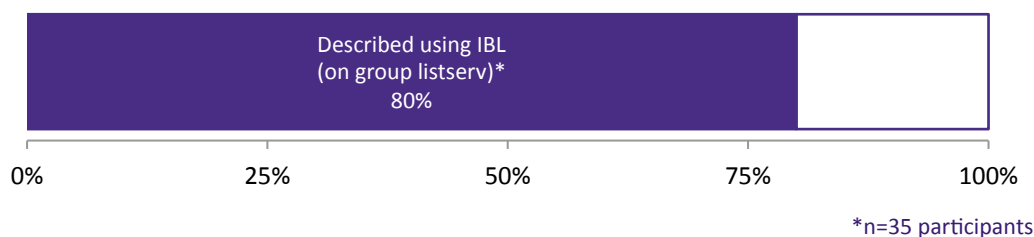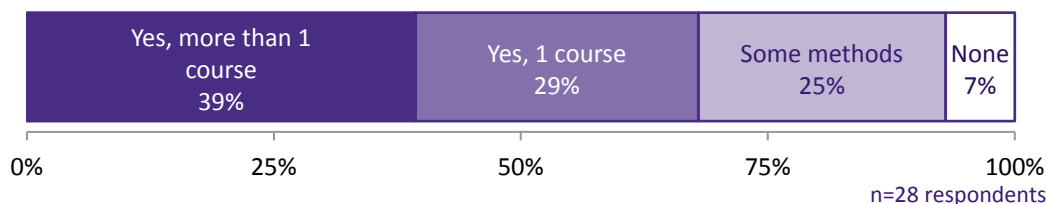Ethnography & Evaluation Research, University of Colorado Boulder

This evaluation report shares findings from the follow-up surveys conducted with participants from Workshop 2, held June 23-26, 2014 at Kenyon College, Gambier, OH, and from Workshop 3, held August 3-6, 2014 in Portland, OR. After a full academic year (about 15 months) following the workshop, we surveyed participants to see if they were using IBL methods in their classes and to learn more about the outcomes from the workshop. Detailed descriptions of the project, the data set, and the research methods are available in a previous report (Hayward & Laursen, 2013). The follow-up surveys were administered through Survey Monkey in November 2015. Results are presented separately for each of the workshops. A cumulative analysis is forthcoming.

Kenyon 2014
Follow-up Surveys

Attendance and Survey Response Rates

This is a high response rate on the follow-up survey. Successful matching indicates that results shared here are generally representative of the workshop attendees. However, we cannot assume non-respondents are similar to respondents in all ways.

Outcomes

Results shared throughout this report are only for the follow-up survey respondents (28 of 35, 80%), except where noted. Implementation rates for all participants may differ from those values presented here, as we do not know if survey non-respondents implemented in the same ways that survey respondents did.
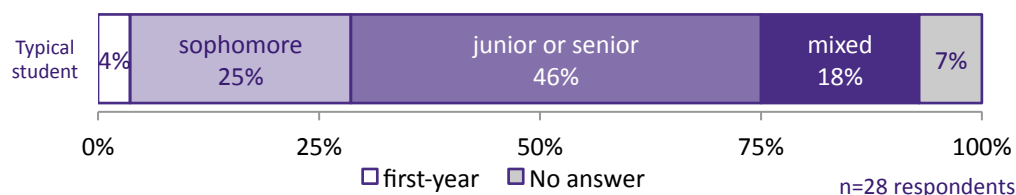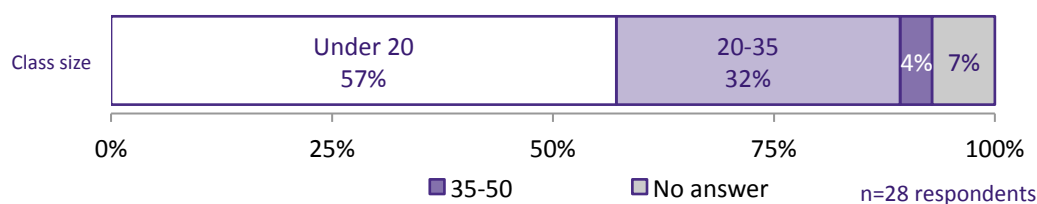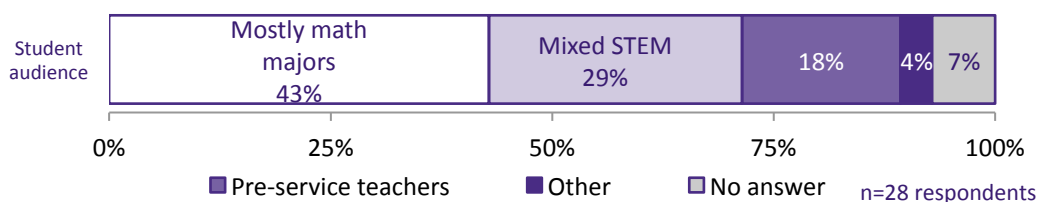
Implementation

Yes, more than 1 course 39%	Yes, 1 course 29%	Some methods 25%	None 7%

0%　　　　25%　　　　50%　　　　75%　　　　100%

n=28 respondents

Described using IBL (on group listserv)* 80%	

0%　　　　25%　　　　50%　　　　75%　　　　100%

*n=35 participants

Spreading IBL to:

78+ classes　　　　**1880+** students

in the first year following the workshop.

Student audience

Mostly math majors 43%	Mixed STEM 29%	18%	4%	7%

0%　　　　25%　　　　50%　　　　75%　　　　100%

■ Pre-service teachers ■ Other □ No answer　　n=28 respondents

Class size

Under 20 57%	20-35 32%	4%	7%

0%　　　　25%　　　　50%　　　　75%　　　　100%

■ 35-50 □ No answer　　n=28 respondents

Typical student

4%	sophomore 25%	junior or senior 46%	mixed 18%	7%

0%　　　　25%　　　　50%　　　　75%　　　　100%

□ first-year □ No answer　　n=28 respondents

Changes in Teaching Practices

Initial teaching practices   *Follow-up teaching practices*

Practice	Initial	Follow-up	Significance
Ins lectures	39% / 21% / 4 / 4 / 7% / 25%	4 / 18% / 11% / 36% / 25% / 7%	**
Ins solves problems	46% / 11% / 7% / 11% / 25%	4 / 21% / 18% / 39% / 11% / 7%	**
Ins asks conceptual Qs	29% / 21% / 11% / 14% / 25%	25% / 46% / 14% / 4 / 4 / 7%	
Ins-led discussion	14% / 11% / 21% / 7% / 21% / 25%	29% / 29% / 32% / 4 / 7%	*
Stu-led discussion	4 / 7% / 4 / 4 / 54% / 29%	21% / 21% / 21% / 4 / 21% / 11%	**
Small group discussion	7% / 14% / 14% / 7% / 32% / 25%	46% / 11% / 25% / 4 / 7% / 7%	**
Stu working in groups	11% / 25% / 25% / 14% / 25%	43% / 25% / 21% / 4 / 7%	**
Stu solve probs alone	11% / 14% / 11% / 7% / 32% / 25%	14% / 4 / 11% / 25% / 36% / 11%	
Stu write in class	4 / 7% / 11% / 4 / 50% / 25%	11% / 4 / 7% / 14% / 57% / 7%	
Stu present problems/proofs	11% / 7% / 14% / 11% / 32% / 25%	57% / 14% / 18% / 4 / 7%	***
Stu work on computers	4 / 4 / 18% / 50% / 25%	4 / 18% / 4 / 68% / 7%	

Legend: ■ Every class ■ Weekly ■ Twice a month ■ Once a month □ Never ■ No answer

n=28 respondents

*p<0.05, **p<0.01, ***p<0.001

Of those who responded to the survey, 93% reported implementing at least some IBL methods. Overall, this means at least 74% of the 35 workshop participants have implemented some IBL in the year following the workshop. We also analyzed listserv traffic to measure implementation. In total, 91% of all workshop participants were active on the listserv, and 86% of all participants made comments indicating that they were implementing IBL. While we cannot directly compare survey answers with listserv implementation information, we can rule out non-responders to the two methods to get an overall implementation rate. Doing so indicates that the overall IBL implementation rate for all 35 participants is at least 89%.

Changes in teaching practices also revealed a shift towards IBL pedagogies with significant decreases in instructors lecturing and solving problems, and significant increases in student-centered activities including instructor and student-led whole class discussions, small group discussions, group work, and student presentations.

The instructors who did implement IBL have exposed almost 1900 students to IBL methods in over 78 classes in just the first year after the workshop. Most commonly, they taught small to midsize classes (under 35 students) for math and other STEM majors of all levels. Participants implemented IBL in a variety of courses, including calculus courses, linear algebra, Introduction to Proof, geometry, graph theory, and others. Many used IBL in the fall term right after the workshop (54%).

Open-ended prompts:
Throughout the remainder of the report, we share responses to open-ended prompts, as well as to multiple choice survey items. For each open-ended prompt, the numbers in parentheses indicates how many of the 28 survey completers responded to the prompt and the number of topics that were coded in all responses. (Participants sometimes included multiple topics in their response to a prompt.) The bulleted lists show the most frequent responses and the number of participants who mentioned each topic. The numbers in the lists provide an estimate of relative importance.

Perceived Effects of IBL on Students

Category	Negative	Little or no	Some positive	Strong positive	No answer
Learning specific mathematical ideas	11	11	50%	18%	11
Understanding math concepts more deeply			25%	68%	7
Applying math to other fields		39%	46%	7	7
Applying math to everyday life		46%	36%	11	7
Understanding nature of math		4	36%	57%	4
Understanding role of proof in math		7	46%	39%	7
Thinking critically			11	86%	4
Developing skills in problem-solving			18%	79%	4
Becoming more independent in problem-solving			4	93%	4
Gaining confidence in doing math			25%	71%	4
Communicating math orally			29%	68%	4
Communicating math in writing			50%	46%	4
Appreciating beauty and significance of math		7	57%	29%	7

-100% -75% -50% -25% 0% 25% 50% 75% 100%

■ Negative   □ Little or no   ■ Some positive   ■ Strong positive   □ No answer
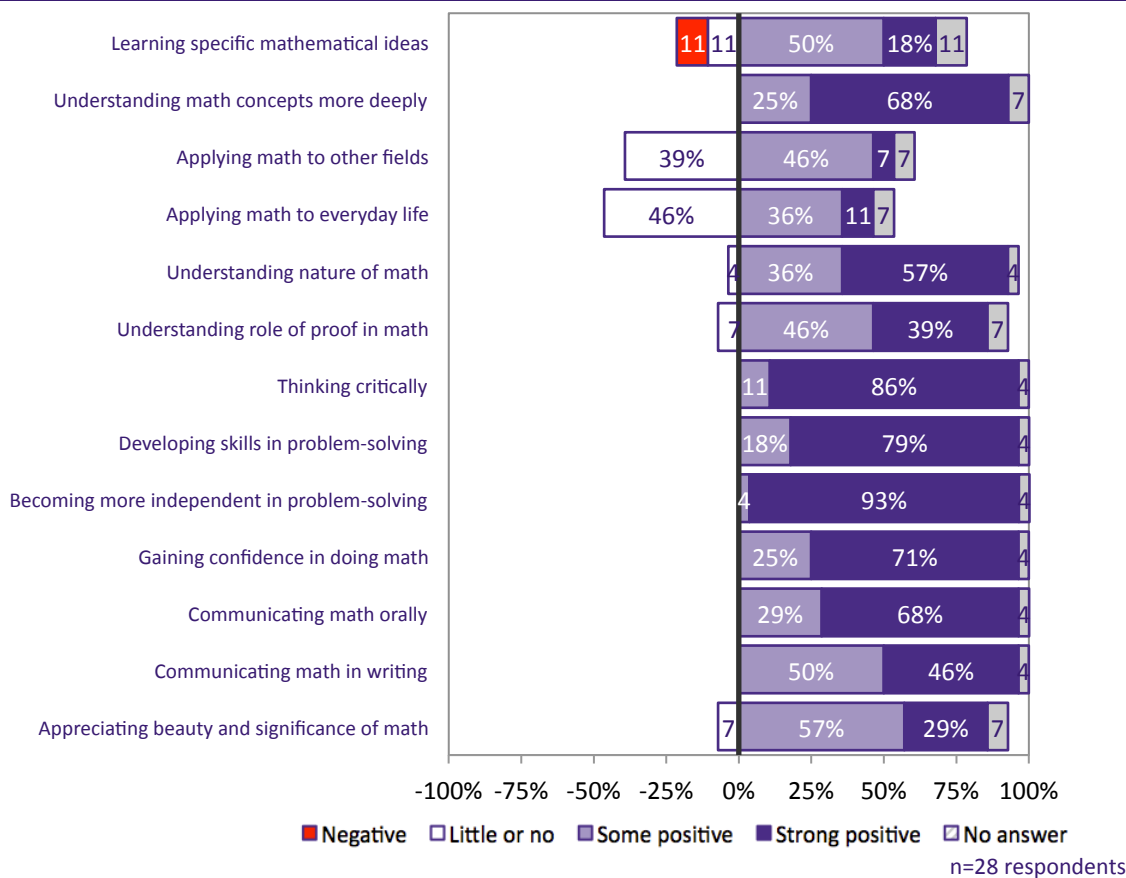
n=28 respondents

Greatest student benefit (22 respondents, 33 coded topics)
- Deeper mathematical understanding (12)
- Behave like mathematicians/ do real mathematics (6)
- More engagement in class (5)
- Improved confidence (3)

Concerns about what students may NOT gain (21 respondents, 23 coded topics)
- Coverage/exposure to certain topics (10)
- Student resistance to IBL (6)
- Students are too independent (can't judge correctness, don't learn formal names/procedures, etc.) (6)

Respondents felt that IBL had many positive effects on students, both in terms of mathematical content and affective gains. In multiple choice responses and open-ended comments, some of the strongest reported effects were that students became more independent in problem-solving and improved their critical thinking. Few participants felt that IBL had negative effects, but some were concerned about coverage and student resitence. Participants reported some of weakest effects on applying math to everyday life and to other fields.

Perspectives on IBL
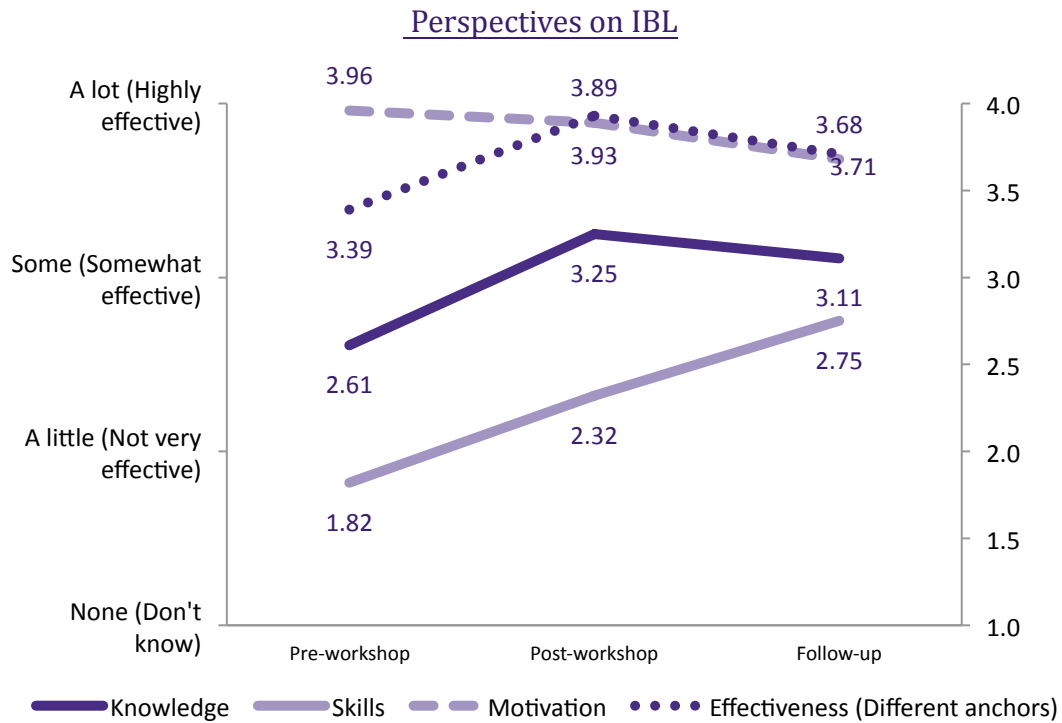
Knowledge of IBL increased significantly post-workshop and then did not change significantly during the follow-up period. IBL skills increased after the workshop, and increased again during the follow-up period. After increasing post-workshop, belief in the effectiveness of IBL experienced a slight decrease during the follow-up period. Belief in the effectiveness of IBL on the follow-up survey was not significantly different than on the pre-workshop survey. Motivation to use IBL decreased modestly on each survey, but these differences were not significant. However, motivation to use IBL was significantly lower on the follow-up survey than on the pre-workshop survey. These ratings and trends are consistent with those from previous IBL workshops.

Overall, these patterns indicate that participants learned a lot about IBL during the workshop. They felt they gained skill in using IBL by attending and they continued to gain skills as they implemented IBL in their own classrooms. Participants entered the workshop reporting high levels of motivation to use IBL. Although participants' reported motivation to use IBL did drop, it still remained quite high on the scale. Participants also entered feeling IBL was an effective teaching method. Their beliefs in its effectiveness increased after the workshop, but returned to about pre-workshop levels after implementing IBL. These patterns make sense for participants in their first year of implementing a new teaching method; while they are gaining skills, they are probably also finding it challenging. Ongoing support may be helpful for participants to work through difficulties and continue using IBL.

Feedback on the Workshop

Most useful aspect of workshop for implementing IBL (25 respondents, 33 coded topics)
- Video sessions (11)
- Examples of how to do IBL, learning specific strategies (6)
- Planning time (5)
- Experienced staff to share ideas (3)
- Motivation/ encouragement/ confidence to use IBL (3)

Use of materials participants developed at the workshop (24 respondents, 28 coded topics)
- Used materials to teach IBL course (10)
- Used selected activities (9)
- Plan to use in the future (4)
- Did not use the materials (3)

Other helpful resources (16 respondents, 23 coded topics)
- JIBLM/ other course notes (7) and IBL books (7)
- IBL colleagues (4)
- Legacy conference (2)

Resources desired (15 respondents, 16 coded topics)
- Contact/ networking with other IBLers (5)
- Time to develop courses (3)
- Advice and additional ideas for IBL courses (3)
- More IBL materials (2)
- Access to videos of IBL classes (2)

Taken together, open-ended feedback suggests that one year later, participants felt that the workshop had been useful in helping them implement IBL in their own classrooms. Whereas participants from the prior workshop most frequently identified the staff as the most helpful aspect of the workshop, participants from this workshop identified the video sessions, examples of specific strategies, and planning time more frequently than they did the staff. This may be due to the reworking and strengthening of the video, Nuts & Bolts, and content sessions that organizers did between workshop 1 and 2. However, it also suggests that the most useful aspects of the workshops have shifted to the features of the workshop model itself, rather than the individuals running the workshops. This is an encouraging finding for the upcoming ProDUCT project, which aims to train others to implement the SPIGOT workshop model.

Participants took advantage of other resources offered throughout the IBL community, including books and shared course notes. Participants valued the network of other IBLers they already had, but also wanted to meet and work with even more IBL practitioners.

Implementation of IBL

Personal gains for instructors (21 respondents, 30 coded topics)
- Helped me be a better teacher/understand student thinking (12)
- More enjoyable way to teach (8)
- Better relationships with students (4)
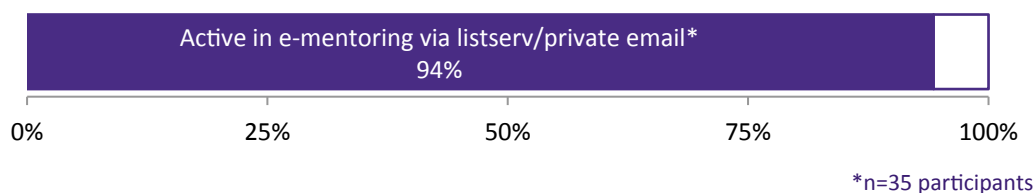- Improved instructor's own mathematical ability (4)

Problems experienced (23 respondents, 34 coded topics)
- Student resistance (19)
- Implementing IBL is challenging (e.g. managing group work & presentations) (6)
- Coverage/exposure to certain topics (4)
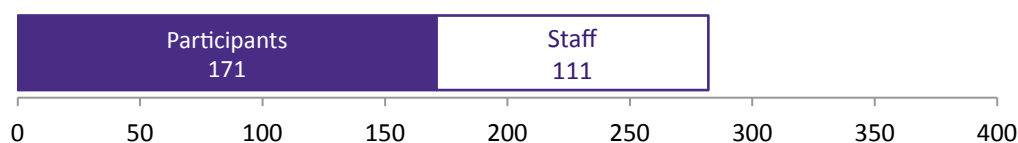- IBL takes more time to plan and implement (4)

Overall, many instructors felt they were better teachers through using IBL. The main problems they experienced were the same as those concerns that respondents shared on pre-workshop and post-workshop surveys: coverage, the difficulty of implementing IBL, and student resistance. These continue to be challenges for instructors, but on the whole, did not stop them from using IBL methods. Ongoing support should continue to provide advice and resources to help participants manage these challenges and improve their skills as IBL instructors.
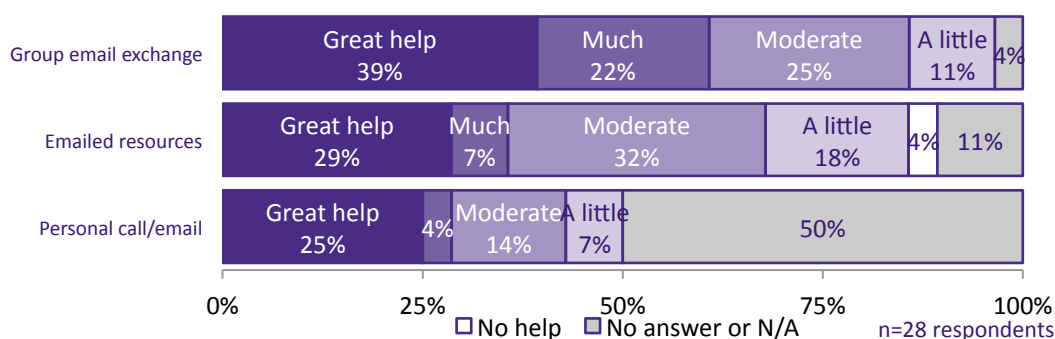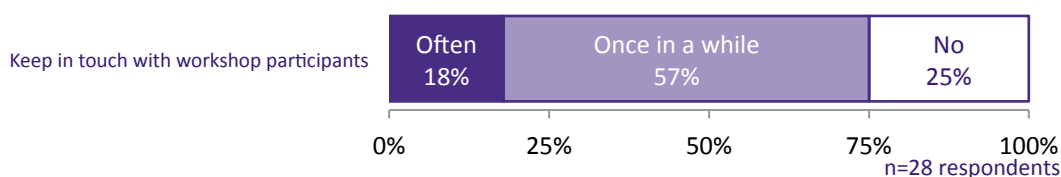
Ongoing Support

Workshop Resources

Active in e-mentoring via listserv/private email*
94%

| 0% | 25% | 50% | 75% | 100% |

*n=35 participants

Group listserv messages in one year following workshop

| Participants 171 | Staff 111 |

| 0 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 |

Helpfulness of e-mentoring activities

	Great help	Much	Moderate	A little	No help	No answer or N/A
Group email exchange	39%	22%	25%	11%	4%	
Emailed resources	29%	7%	32%	18%	4%	11%
Personal call/email	25%	4%	14%	7%		50%

| 0% | 25% | 50% | 75% | 100% |

☐ No help ☐ No answer or N/A   n=28 respondents

Keep in touch with workshop participants	Often 18%	Once in a while 57%	No 25%

0%   25%   50%   75%   100%

n=28 respondents

Institutional Support

Colleagues in department	Mostly supportive 50%	mixed/moderate 46%	4%
Department head/chair	Mostly supportive 64%	mixed/moderate 32%	4%
Dean/provost	Mostly supportive 46%	mixed/moderate 36%	18%
Colleagues outside department	Mostly supportive 36%	mixed/moderate 46%	18%

0%   25%   50%   75%   100%

☐ Mostly not supportive   ☐ Not at all supportive   ☐ No answer

n=28 respondents

Descriptions of departmental/institutional IBL support (21 respondents, 23 coded topics)
- Encouragement - other IBL instructors or financial support/resources (12)
- Freedom to 'do what I want' (5)
- Doubtful or discouraging colleagues (3)

Other IBL Supports
IBL events

Attended another IBL event 68%	No 18%	No answer 14%

Presented at IBL event 25%	No 18%	No answer 57%

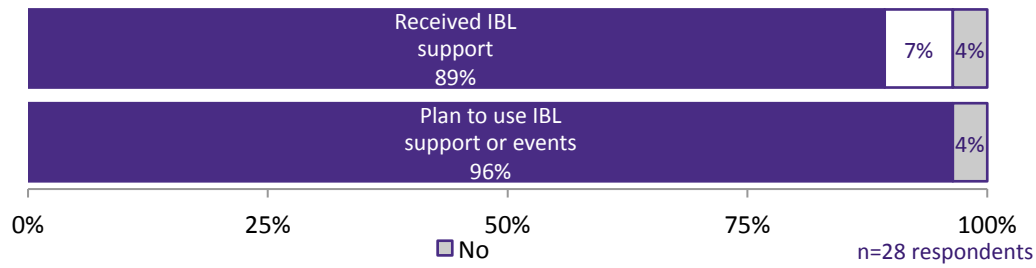| Either attended or presented 79%	No 14%	No answer 7%

0%   25%   50%   75%   100%

n=28 respondents
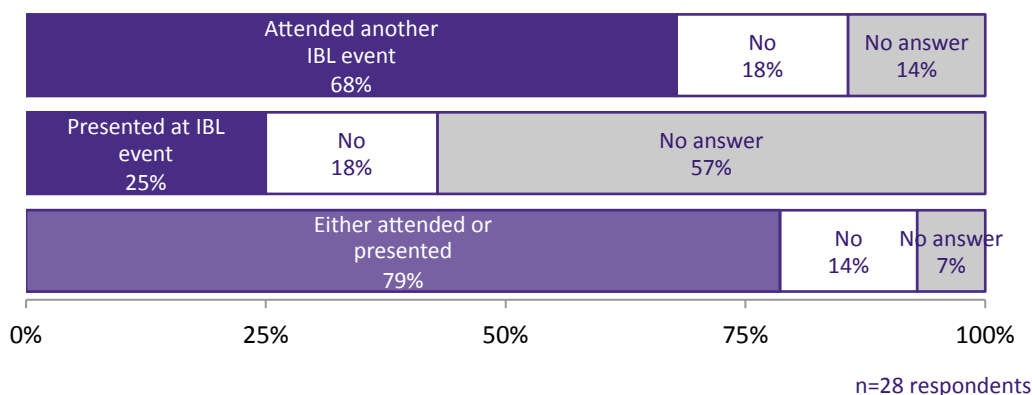
Attended
- IBL sessions at JMM 2015 (10)
- IBL session at MAA meeting (9)
- IBL booth at MathFest 2014 (6)
- Legacy of R.L. Moore/IBL Conference (5)
- IBL poster at MathFest 2014 (2)
- Other (2)

Presented
- Legacy of R.L. Moore/IBL Conference (4)
- IBL sessions at JMM 2015 (3)
- IBL session at MAA meeting (3)
- IBL booth at MathFest 2014 (1)
- IBL poster at MathFest 2014 (1)
- Other (0)

Use of IBL supports

Received IBL support 89%	7%	4%
Plan to use IBL support or events 96%		4%

0% 25% 50% 75% 100%

□ No   n=28 respondents

Received
- Read workshop listserv (21)
- Contributed to listserv (13)
- Used notes from JIBLM (12)
- Used AIBL mentor program (4)
- Received AIBL minigrant (3)

Plan to in the future
- Will use notes from JIBLM (20)
- Will read workshop listserv (18)
- Will attend Legacy of R.L. Moore/IBL Conference (16)
- Will attend IBL session at JMM (15)
- Will contribute to listserv (15)
- Will apply for AIBL minigrant (13)
- Will attend IBL session at MAA (12)
- Will submit notes to JIBLM (10)
- Will attend IBL session at MathFest (8)
- Will use AIBL mentor program (8)
- AIBL visiting speaker's bureau (2)

Like participants' open-ended feedback on the workshop, these items also indicate that many participants took advantage of the resources available from the workshop, as well as those offered by the Academy of Inquiry Based Learning (AIBL). It appears that more participants used easily accessible, electronic resources such as the listserv and JIBLM, and fewer did more intensive activities like attending conferences. In the future, most participants plan to use some items from the suite of resources, including many who plan to attend IBL events at conferences. Given the variety of resources participants intend to use, it may be critical that they have the option to choose among many resources in order to find whichever one is best-suited to their own needs.

Conclusion

Results from the follow-up surveys help to learn about impact of the workshop on participants' teaching practices. At least 74% of all workshop participants (93% of the 28 respondents) reported using at least some IBL methods in the year following the workshop. This proportion from survey self-report is slightly lower that found by analyzing messages sent through the group listserv (86% of all participants), probably because more participants were active on the listserv (94%) than responded to the followup survey (80%). The implementation rates are similar to those from Workshop 1 from 2013 (74% and 76%, respectively).

Even though this workshop was slightly smaller than Workshop 1, participants have again spread IBL methods to about 1900 students in almost 80 courses in just the first year following the workshop. Despite common beliefs that IBL is just for very small upper-level math major courses, many courses did not match these assumptions. However, the classes participants reported using IBL in were slightly more aligned with these assumptions than those from Workshop 1, as only 36% of participants used IBL in classes that had 20 or more students, 51% in classes serving non-math majors, and 47% in non upper-level courses. Participants reported that using IBL had many positive effects on their students - in fact, almost all effects reported were positive - especially development of independence and critical thinking.

Again with Workshop 2, results indicate that follow-up support is important for participants. Almost all respondents (89%) reported using some form of support, and many used more than one. The workshop listserv was the most commonly used form of support, as 91% of participants were active on the listserv at least once. While staff often prompted discussions and responded to questions on the listserv, participants themselves were very active, sending an average of 4.9 messages per workshop participant. Participants either used or plan to use many of the available supports, so again, the variety of opportunities seems to allow each person to find one that works for him or her.
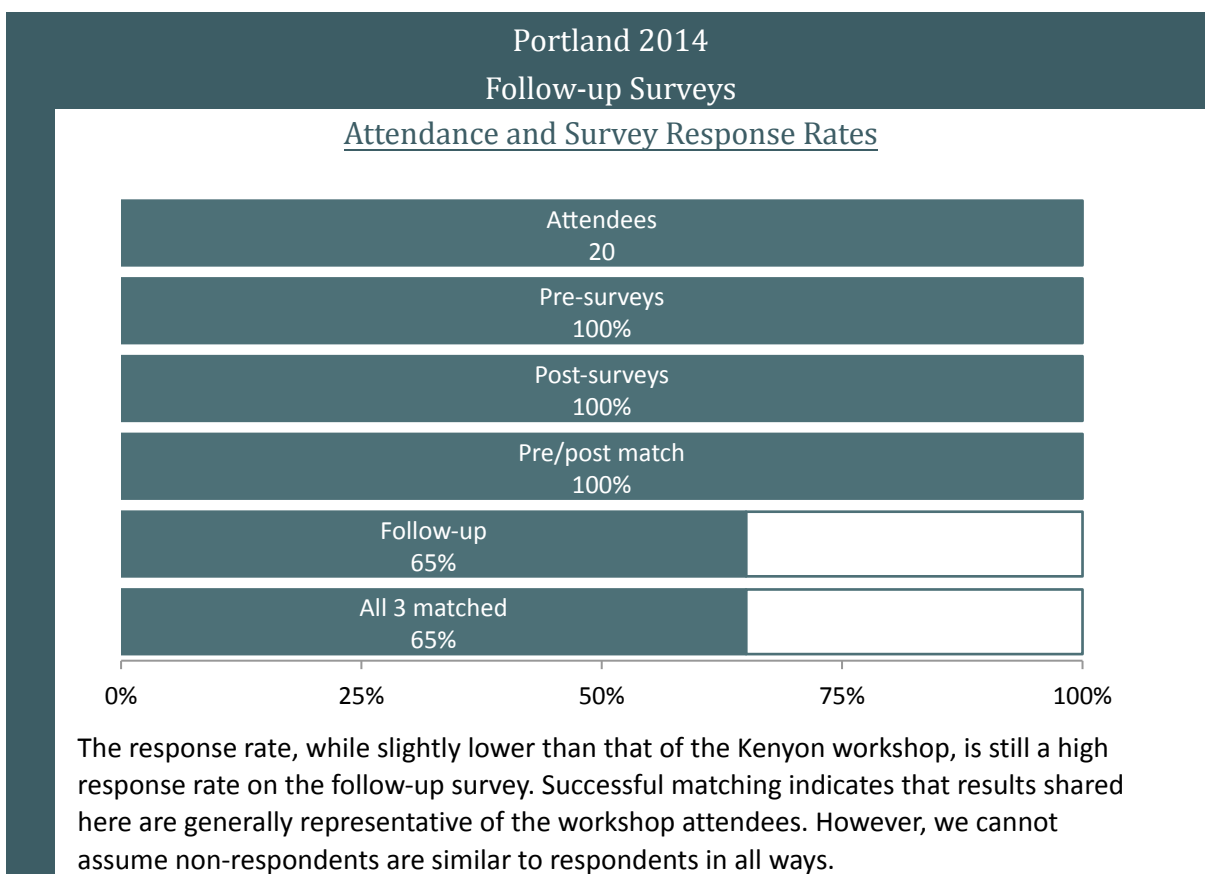
Like all previous workshop evaluation reports, student resistance and content coverage remain as challenges for participants implementing IBL. Given the focus on these topics at the workshop and the high rate of IBL implementation, it appears that participants felt prepared to manage these concerns.

References

Hayward, C. & Laursen, S. (2013). Collaborative research: Supporting pedagogical innovation for a generation of transformation via inquiry-based learning in mathematics (SPIGOT) evaluation report: Workshop 1 at California Polytechnic State University, San Luis Obispo, June 24-27, 2013. Ethnography & Evaluation Research. Center to Advance Research and Teaching in the Social Sciences. University of Colorado Boulder.
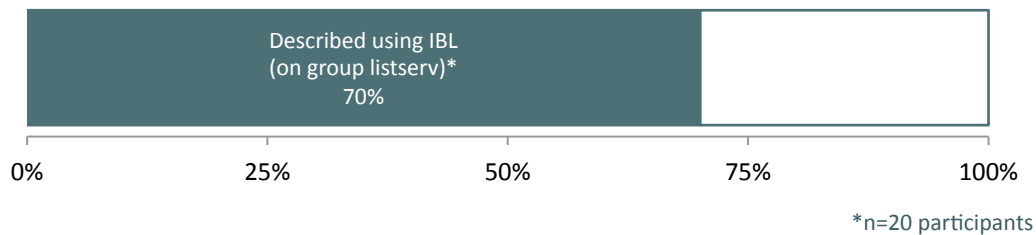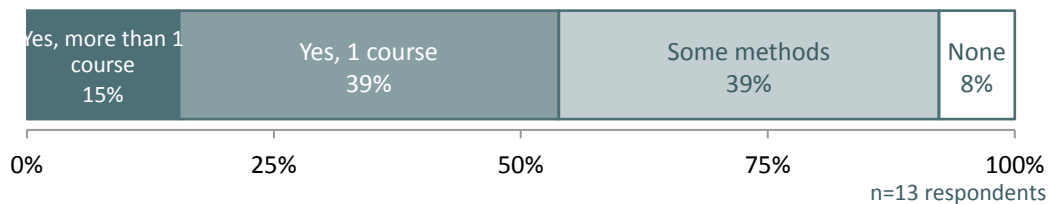
Workshop 3: Portland, Follow-Up Report

The Portland workshop was held about one month after the Kenyon workshop. It was held in conjunction with MathFest, also in Portland. In terms of content and structure, it was almost identical to the Kenyon workshop. Of note, the workshop was smaller than the prior two workshops. It served 20 participants, while the first two served 42 and 35, respectively. Demographically, the Portland group tended to be more advanced in their careers than the participants in the first two workshops were.

Portland 2014
Follow-up Surveys
Attendance and Survey Response Rates

Category	Value
Attendees	20
Pre-surveys	100%
Post-surveys	100%
Pre/post match	100%
Follow-up	65%
All 3 matched	65%

0%   25%   50%   75%   100%

The response rate, while slightly lower than that of the Kenyon workshop, is still a high response rate on the follow-up survey. Successful matching indicates that results shared here are generally representative of the workshop attendees. However, we cannot assume non-respondents are similar to respondents in all ways.

Outcomes

Results shared throughout this report are only for the follow-up survey respondents (13 of 20, 65%), except where noted. Implementation rates for all participants may differ from those values presented here, as we do not know if survey non-respondents implemented in the same ways that survey respondents did.
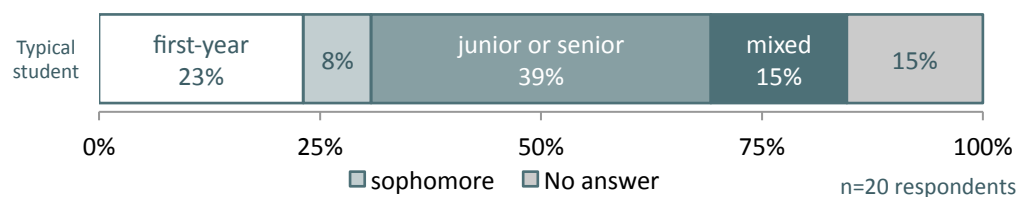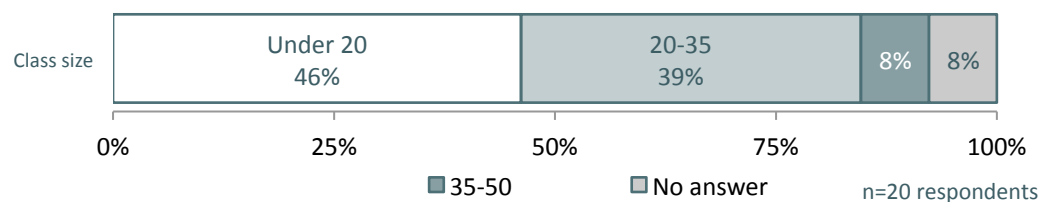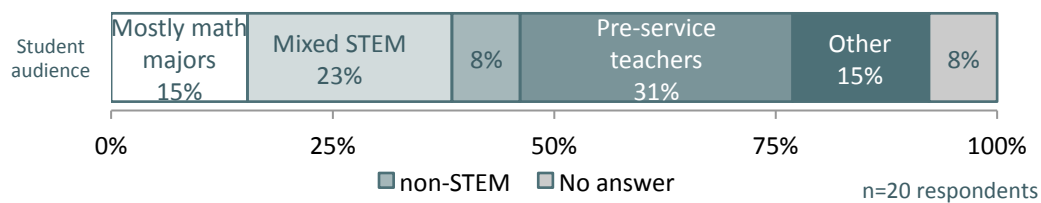
Implementation

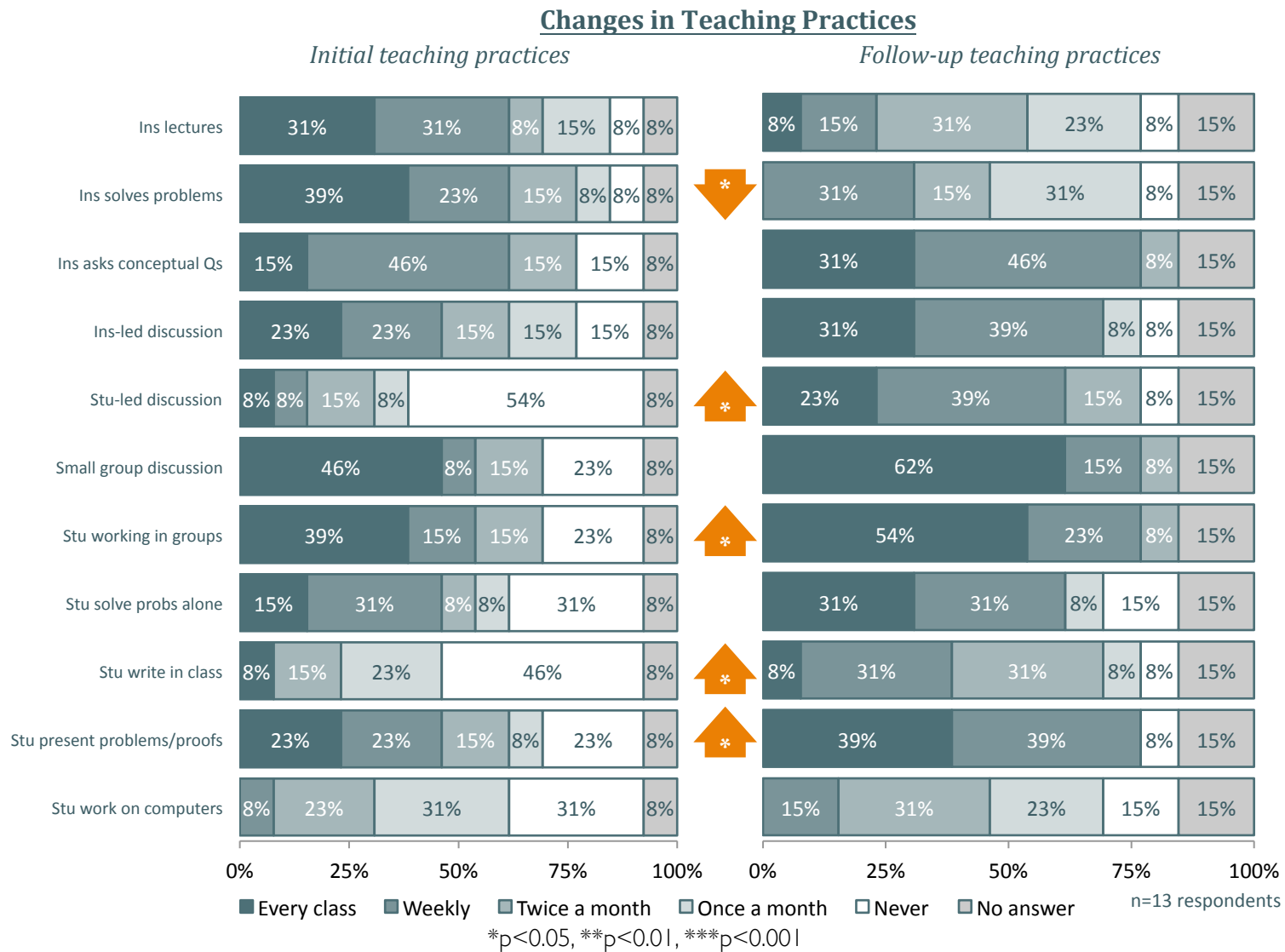| Yes, more than 1 course 15%	Yes, 1 course 39%	Some methods 39%	None 8%

0%   25%   50%   75%   100%

n=13 respondents

Described using IBL (on group listserv)* 70%	

0%   25%   50%   75%   100%

*n=20 participants

Spreading IBL to:

31+
classes

850+
students

in the first year following the workshop.

Student audience	Mostly math majors 15%	Mixed STEM 23%	8%	Pre-service teachers 31%	Other 15%	8%

0%   25%   50%   75%   100%

☐ non-STEM   ☐ No answer

n=20 respondents

Class size	Under 20 46%	20-35 39%	8%	8%

0%   25%   50%   75%   100%

☐ 35-50   ☐ No answer

n=20 respondents

Typical student	first-year 23%	8%	junior or senior 39%	mixed 15%	15%

0%   25%   50%   75%   100%

☐ sophomore   ☐ No answer

n=20 respondents

Changes in Teaching Practices

Initial teaching practices   *Follow-up teaching practices*

Ins lectures
Initial: 31% | 31% | 8% | 15% | 8% | 8%
Follow-up: 8% | 15% | 31% | 23% | 8% | 15%

Ins solves problems *
Initial: 39% | 23% | 15% | 8% | 8% | 8%
Follow-up: 31% | 15% | 31% | 8% | 15%

Ins asks conceptual Qs
Initial: 15% | 46% | 15% | 15% | 8%
Follow-up: 31% | 46% | 8% | 15%

Ins-led discussion
Initial: 23% | 23% | 15% | 15% | 15% | 8%
Follow-up: 31% | 39% | 8% | 8% | 15%

Stu-led discussion *
Initial: 8% | 8% | 15% | 8% | 54% | 8%
Follow-up: 23% | 39% | 15% | 8% | 15%

Small group discussion
Initial: 46% | 8% | 15% | 23% | 8%
Follow-up: 62% | 15% | 8% | 15%

Stu working in groups *
Initial: 39% | 15% | 15% | 23% | 8%
Follow-up: 54% | 23% | 8% | 15%

Stu solve probs alone
Initial: 15% | 31% | 8% | 8% | 31% | 8%
Follow-up: 31% | 31% | 8% | 15% | 15%

Stu write in class *
Initial: 8% | 15% | 23% | 46% | 8%
Follow-up: 8% | 31% | 31% | 8% | 8% | 15%

Stu present problems/proofs *
Initial: 23% | 23% | 15% | 8% | 23% | 8%
Follow-up: 39% | 39% | 8% | 15%

Stu work on computers
Initial: 8% | 23% | 31% | 31% | 8%
Follow-up: 15% | 31% | 23% | 15% | 15%

Axis: 0% | 25% | 50% | 75% | 100%

Legend: ■ Every class ■ Weekly ■ Twice a month □ Once a month □ Never ■ No answer

n=13 respondents

*p<0.05, **p<0.01, ***p<0.001

Of those who responded to the survey, 92% reported implementing at least some IBL methods. Overall, this means at least 60% of the 20 workshop participants have implemented some IBL in the year following the workshop. We also analyzed listserv traffic to measure implementation. In total, 90% of all workshop participants were active on the listserv, and 70% of all participants made comments indicating that they were implementing IBL. While we cannot directly compare survey anwers with listserv implementation information, we can rule out non-responders to the two methods to get an overall implementation rate. Doing so indicates that the overall IBL implementation rate for all 20 participants is at least 80%.

Changes in teaching practices revealed shifts towards IBL pedagogies with significant decreases in instructors solving problems, and significant increases in student-centered activities including student-led discussions, group work, student writing in class, and student presentations. While many of these changes are consistent with previous workshops, some are not. For example, the frequency of lecturing did not decrease significantly as it has with every other workshopwe have ever studied. This is most likely due to the small sample size (only 13 participants had matched surveys). In fact, many results were just outside the range of statistical significance, and those that were significant showed weaker significance than results from prior, larger workshops.

The instructors who did implement IBL have exposed more than 850 students to IBL methods in over 31 classes in just the first year after the workshop. While these numbers are less than previous workshops, they are on par for the smaller group size. Most commonly, participants taught small to midsize classes (under 35 students) for math and other STEM majors of all levels. Participants implemented IBL in a variety of courses, most commonly pre-service teacher courses (4), calculus track courses (3), and proof courses (2), as well as some others. Ten participants (77% of respondents) reported using IBL in the fall term right after the workshop.

Open-ended prompts:

Throughout the remainder of the report, we share responses to open-ended prompts, as well as to multiple choice survey items. For each open-ended prompt, the numbers in parentheses indicates how many of the 13 survey completers responded to the prompt and the number of topics that were coded in all responses. (Participants sometimes included multiple topics in their response to a prompt.) The bulleted lists show the most frequent responses and the number of participants who mentioned each topic. The numbers in the lists provide an estimate of relative importance.

Perceived Effects of IBL on Students

Category	Negative	Little or no	Some positive	Strong positive	No answer
Learning specific mathematical ideas		15%	54%	23%	8
Understanding math concepts more deeply		15%		77%	8
Applying math to other fields		23%	54%	15%	8
Applying math to everyday life		23%	54%	15%	8
Understanding nature of math		15%	39%	39%	8
Understanding role of proof in math		15%	39%	39%	8
Thinking critically		15%		77%	8
Developing skills in problem-solving		8		85%	8
Becoming more independent in problem-solving		8	23%	62%	8
Gaining confidence in doing math			46%	46%	8
Communicating math orally		8	23%	62%	8
Communicating math in writing		15%	46%	23%	15%
Appreciating beauty and significance of math		23%	62%	8	8

■ Negative ☐ Little or no ■ Some positive ■ Strong positive ☐ No answer
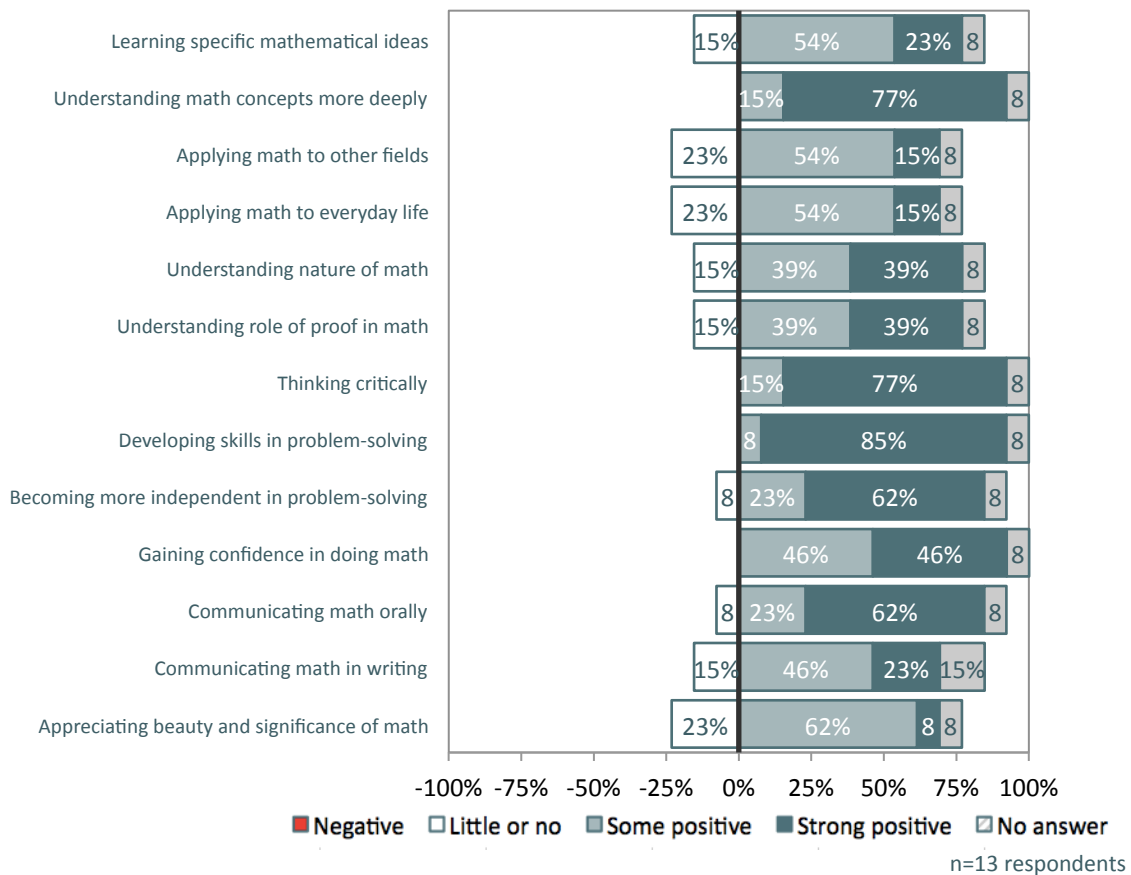
n=13 respondents

Greatest student benefit (10 respondents, 14 coded topics)
- Behave like mathematicians/ do real mathematics (4)
- Deeper mathematical understanding (3)
- More independence doing mathematics (3)

Concerns about what students may NOT gain (9 respondents, 9 coded topics)
- Coverage/exposure to certain topics (4)
- IBL doesn't fit with other lecture-based courses/ students not prepared for IBL (2)
- No concerns (2)

Respondents felt that IBL had many positive effects on students, both in terms of mathematical content and affective gains. Some of the strongest reported effects were that students improved their problem-solving and critical thinking abilities. No participants felt that IBL had negative effects, but some were concerned about coverage and how IBL will fit between other, more-traditional math courses. Like the Kenyon workshop, participants reported some of weakest effects on applying math to everyday life and to other fields.

Perspectives on IBL
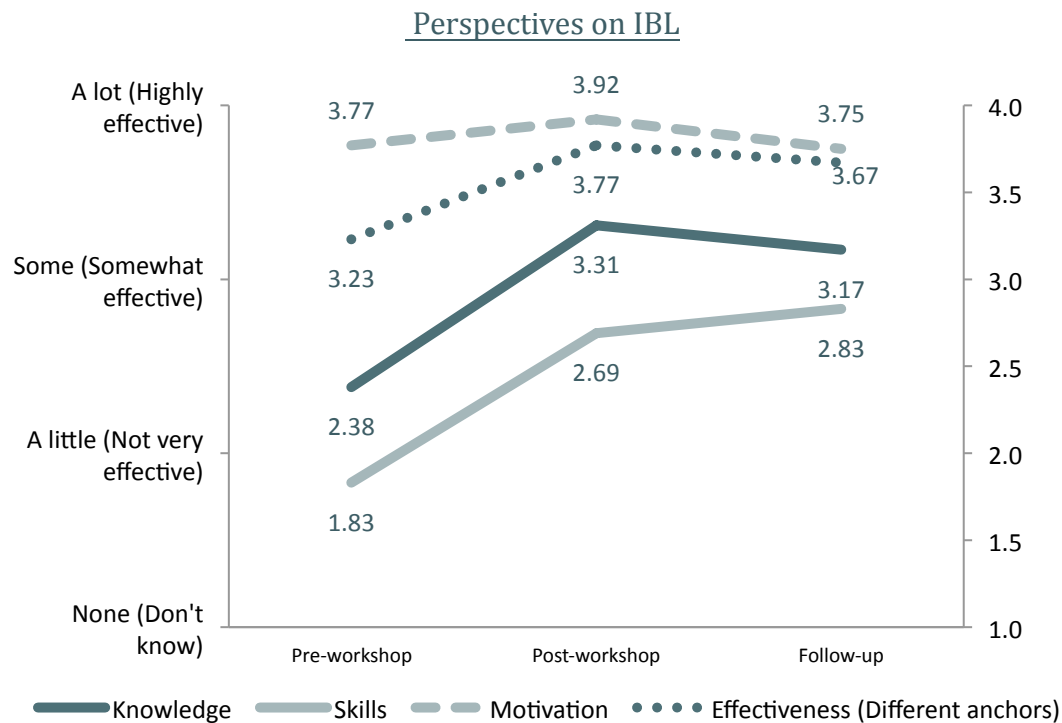
Knowledge of IBL increased significantly post-workshop and then did not change significantly during the follow-up period. IBL skills increased significantly after the workshop, and then showed a non-significant increase during the follow-up period. After increasing post-workshop, belief in the effectiveness of IBL experienced a slight decrease during the follow-up period. Belief in the effectiveness of IBL on the follow-up survey was not significantly different than on the pre-workshop survey. Motivation to use IBL increased modestly after the workshop and decreased modestly by the follow-up survey, but these differences were not significant. Motivation to use IBL was not significantly different on the follow-up survey than on the pre-workshop survey. These ratings and trends are fairly consistent with those from previous IBL workshops.

Overall, these patterns indicate that participants learned a lot about IBL during the workshop. They felt they gained skill in using IBL by attending and they continued to gain skills as they implemented IBL in their own classrooms. Participants entered the workshop reporting high levels of motivation to use IBL, and these levels remained high on all three surveys. Participants also entered feeling IBL was an effective teaching method. Their beliefs in its effectiveness increased after the workshop, but by follow-up, it was no longer significantly different than pre-workshop levels. These patterns make sense for participants in their first year of implementing a new teaching method; while they are gaining skills, they are probably also finding it challenging. Ongoing support may be helpful for participants to work through difficulties and continue using IBL.

Feedback on the Workshop

Most useful aspect of workshop for implementing IBL (9 respondents, 11 coded topics)
- Video sessions (4)
- Planning time (3)
- Examples of how to do IBL, learning specific strategies (2)

Use of materials participants developed at the workshop (9 respondents, 11 coded topics)
- Used materials to teach IBL course (3)
- Used selected activities (3)
- Plan to use in the future (2)
- Did not use the materials (2)

Other helpful resources (7 respondents, 8 coded topics)
- JIBLM/ other course notes (3)
- No additional resources (3)
- NCTM website (1)
- IBL colleagues (1)

Resources desired (7 respondents, 7 coded topics)
- Contact/ networking with other IBLers (2)
- Time/funding to develop courses (2)
- More active & specific group listserv (i.e. 'can't remember who specialized in what classes' (2)

Given the small numbers of responses on open-ended feedback from this workshop, it is difficult to make generalizations. However, patterns in the most frequent responses were quite similar to past workshops and suggest that like previous workshops, participants felt that this Portland workshop had been useful in helping them implement IBL in their own classrooms. Like the Kenyon workshop, the video sessions and content planning sessions were identified most frequently as the most helpful aspects.

Participants took advantage of some other resources offered throughout the IBL community, including shared course notes. Participants valued the network of other IBLers they already had, but also wanted to meet and work with even more IBL practitioners. Unlike other workshops, some participants from this Portland workshop did report that they wanted the group listserv to be more helpful. This workshops's listserv suffered from lower participation that other workshops, which is discussed in the next section.

Implementation of IBL

Personal gains for instructors (9 respondents, 10 coded topics)
- Helped me be a better teacher/understand student thinking (7)
- Better relationships with students (2)
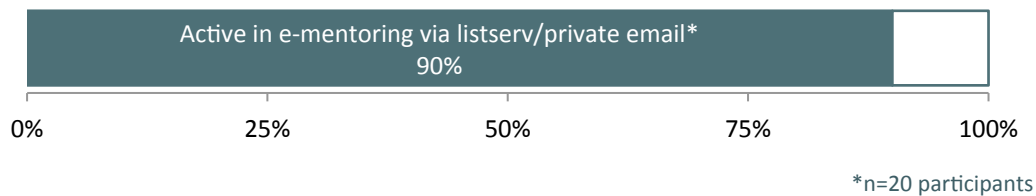- More enjoyable way to teach (1)

Problems experienced (9 respondents, 12 coded topics)
- Student resistance (3)
- Implementing IBL is challenging (e.g. managing bad presentations & pacing) (3)
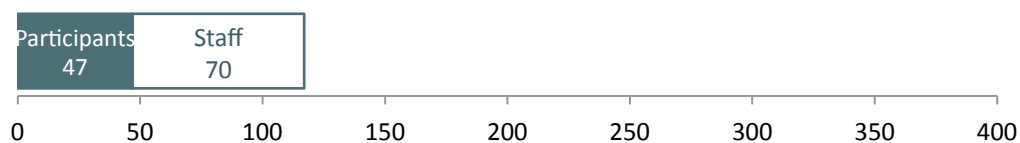- Coverage/exposure to certain topics (2)
- IBL takes more time to plan and implement (2)

Overall, many instructors felt they were better teachers through using IBL. The main problems they experienced were the same as those concerns that respondents shared on pre-workshop and post-workshop surveys: coverage, the difficulty of implementing IBL, and student resistance. These continue to be challenges for instructors, but on the whole, did not stop them from using IBL methods. Ongoing support should continue to provide advice and resources to help participants manage these challenges and improve their skills as IBL instructors.
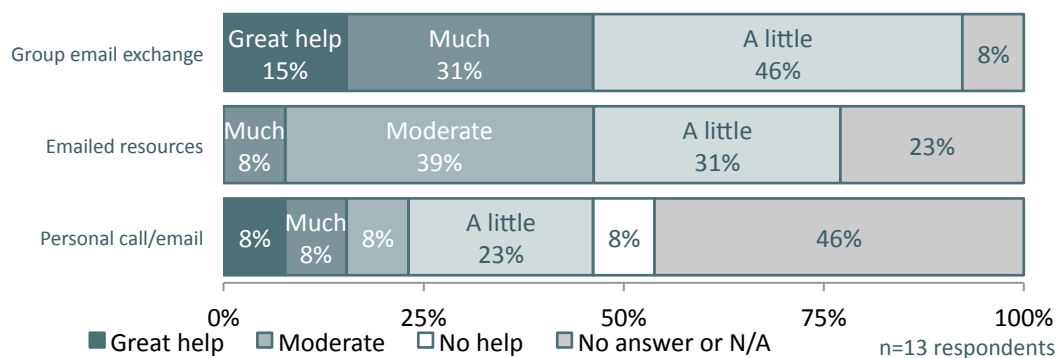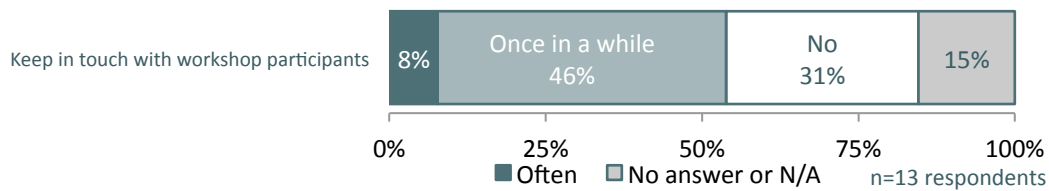
Ongoing Support

Workshop Resources

Active in e-mentoring via listserv/private email*
90%

*n=20 participants

Group listserv messages in one year following workshop

Participants 47
Staff 70

Helpfulness of e-mentoring activities

Group email exchange	Great help 15%	Much 31%	A little 46%	8%
Emailed resources	Much 8%	Moderate 39%	A little 31%	23%
Personal call/email	8%	Much 8% / 8%	A little 23%	8% / 46%

■ Great help ■ Moderate □ No help ■ No answer or N/A   n=13 respondents

Keep in touch with workshop participants	8%	Once in a while 46%	No 31%	15%

0%   25%   50%   75%   100%

■ Often   □ No answer or N/A   n=13 respondents

Institutional Support

Colleagues in department	Mostly supportive 54%	15%	15%	8%	8%
Department head/chair	mixed/moderate 69%		8%	8%	15%
Dean/provost	Mostly supportive 46%	23%	15%	15%	
Colleagues outside department	Mostly supportive 39%	mixed/moderate 31%	15%	15%	

0%   25%   50%   75%   100%

■ mixed/moderate   ■ Mostly not supportive   □ Not at all supportive   ■ No answer
n=13 respondents

Descriptions of departmental/institutional IBL support (6 respondents, 7 coded topics)
- Encouragement - supports philosophy of IBL (2)
- Freedom to 'do what I want' (2)
- No support (2) or skepticism (1)

Other IBL Supports
IBL events

Attended another IBL event 31%	No 31%	No answer 39%
Presented at IBL event 15%	No 31%	No answer 54%
Either attended or presented 38%	No 23%	No answer 39%

0%   25%   50%   75%   100%

n=13 respondents
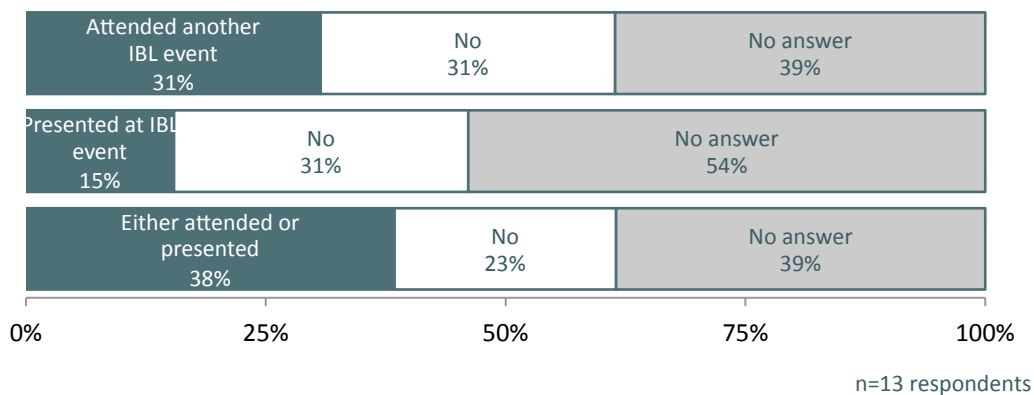
Attended	*Presented*
• IBL sessions at JMM 2015 (3)	• IBL sessions at JMM 2015 (1)
• IBL session at MAA meeting (2)	• IBL session at MAA meeting (1)
• IBL booth at MathFest 2014 (2)	• IBL poster at MathFest 2014 (1)
• IBL poster at MathFest 2014 (2)	• IBL booth at MathFest 2014 (0)
• Legacy of R.L. Moore/IBL Conference (1)	• Legacy of R.L. Moore/IBL Conference (0)
• Other (0)	• Other (0)

Use of IBL supports

Received IBL support 85%	8%	8%	
Plan to use IBL support or events 85%	8%	8%	

0% 25% 50% 75% 100%

☐ No

n=13 respondents
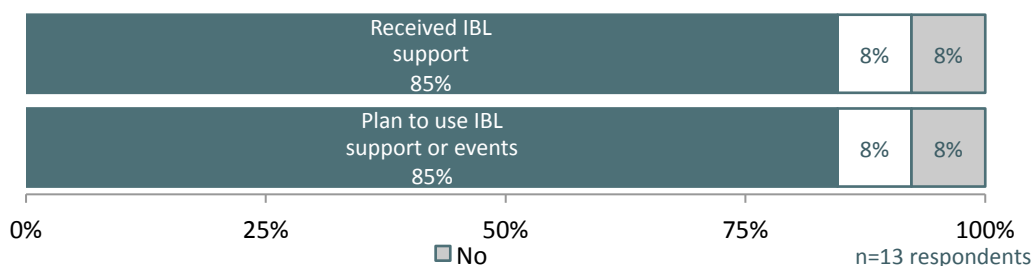
Received
- Read workshop listserv (11)
- Contributed to listserv (7)
- Used notes from JIBLM (3)
- Received AIBL minigrant (1)

Plan to in the future
- Will use notes from JIBLM (7)
- Will read workshop listserv (8)
- Will attend Legacy of R.L. Moore/IBL Conference (6)
- Will attend IBL session at JMM (8)
- Will contribute to listserv (5)
- Will apply for AIBL minigrant (5)
- Will attend IBL session at MAA (6)
- Will submit notes to JIBLM (3)
- Will attend IBL session at MathFest (7)
- Will use AIBL mentor program (2)

Like the prior workshops, it appears that participants used a variety of available resources. More participants used easily accessible, electronic resources such as the listserv and JIBLM and fewer did more intensive activities like attending conferences.

Overall, participants from this workshop were less active in ongoing mentoring activities than prior workshops. For the workshop at Kenyon, there was an average of 4.9 messages sent per participant. For this workshop, the average was only 2.4 messages per participant. Moreover, if staff & participants had the same rates of activity on this listserv as they did for the Kenyon workshop, the predicted numbers adjusted for the size of the workshop would be 63 staff messages (vs. 70 actual) and 98 participant message (vs. 47 actual). So, by comparison, staff were about 10% more active trying to start discussions with the Portland group than they were with the Kenyon group, but Portland participants were only about half as active as what could have been expected. While this may reflect differences in the participants who attended this workshop, it may also be because of the smaller size of this workshop. With fewer participants, there are fewer potential respondents to any given message, which may make it harder to sustain discussions. Possibly because of the lower activity, participants from this workshop also reported that the group listserv was less helpful than participants from prior workshops have reported. It remains an open question what the ideal group size for a workshop like this is. There should be enough participants to foster collaboration and a supportive network for ongoing mentoring activities, but not so large that participants do not receive adequate individual attention.

Conclusion

Results from the follow-up surveys help to learn about the impact of the workshop on participants' teaching practices. At least 60% of all workshop participants reported using at least some IBL methods in the year following the workshop. This proportion from survey self-report is slightly lower that found by analyzing messages sent through the group listserv (70% of all participants). The implementation rates are slightly lower than those reported by participants at the prior workshops, which have been 75% or higher.

Participants from the Portland workshop have spread IBL methods to over 850 students in over 30 courses in just the first year following the workshop. These numbers are on par for the small workshop size. Many participants (85%) used IBL in classes that had 35 students or fewer and 39% were upper-level courses. There were many participants (31%) who reported using IBL in classes for pre-service teachers. Participants reported that using IBL had many positive effects on their students, especially development of critical thinking and problem-solving abilities.

While previous workshops have shown that follow-up support is important for participants, results were weaker for this group. Again, almost all respondents (85%) reported using some form of support, and the workshop listserv was the most commonly used form of support. However, the workshop was less active than with previous workshop cohorts, and participants reported it as being less helpful than did previous workshop cohorts. This is likely due to the small size of this workshop, which seems to have made collaboration on the listserv more difficult.

Like all previous workshop evaluation reports, student resistance and content coverage remain as challenges for participants implementing IBL. Given the focus on these topics at the workshop and the high rate of IBL implementation, it appears that participants felt prepared to manage these concerns.

The results from the Portland workshop are very consistent with prior workshops in many ways, but differ in some key ways - specifically, slightly lower reported IBL implementation and weaker results from ongoing mentoring. The similarities indicate that the workshop model can still be successfully implemented with smaller groups, but the differences suggest that the outcomes may not be as positive. So, while attaching the Portland workshop to MathFest afforded a cost-effective opportunity to offer the SPIGOT IBL workshop model to a small number of participants who may not have attended a stand-alone workshop, in the future, stronger outcomes may be achieved with bigger workshops for around 35-40 participants, as long as sufficient funds are available.

References

Hayward, C. & Laursen, S. (2013). Collaborative research: Supporting pedagogical innovation for a generation of transformation via inquiry-based learning in mathematics (SPIGOT) evaluation report: Workshop 1 at California Polytechnic State University, San Luis Obispo, June 24-27, 2013. Ethnography & Evaluation Research. Center to Advance Research and Teaching in the Social Sciences. University of Colorado Boulder.

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