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

Cumulative Report: Workshops 1-4
March 2016

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

This report covers the pre- and post- workshop survey results for all four of the SPIGOT workshops, and follow-up results for the first three. The only missing results are follow-up survey results for the 2015 workshop. Those data cannot be collected until the Fall of 2016, after the SPIGOT grant will have ended. This is the final report for the SPIGOT project. Quantitative results are presented as averages for all 138 attendees of the four workshops, and can be used as baseline comparative data for the upcoming ProDUCT workshops. Qualitative data, specifically counts of comments, are totals for attendees for all four workshops. Additional results for individual workshops are available in the previous reports, including three pre/post workshop reports and two follow-up reports. (In both cases, the two 2014 workshops were reported on in a single report.) Detailed descriptions of the project, the data set, and the research methods are available in a previous report (Hayward & Laursen, 2013). The survey instruments and methods remained unchanged for all of the workshops.

SPIGOT CUMULATIVE

Overall Project

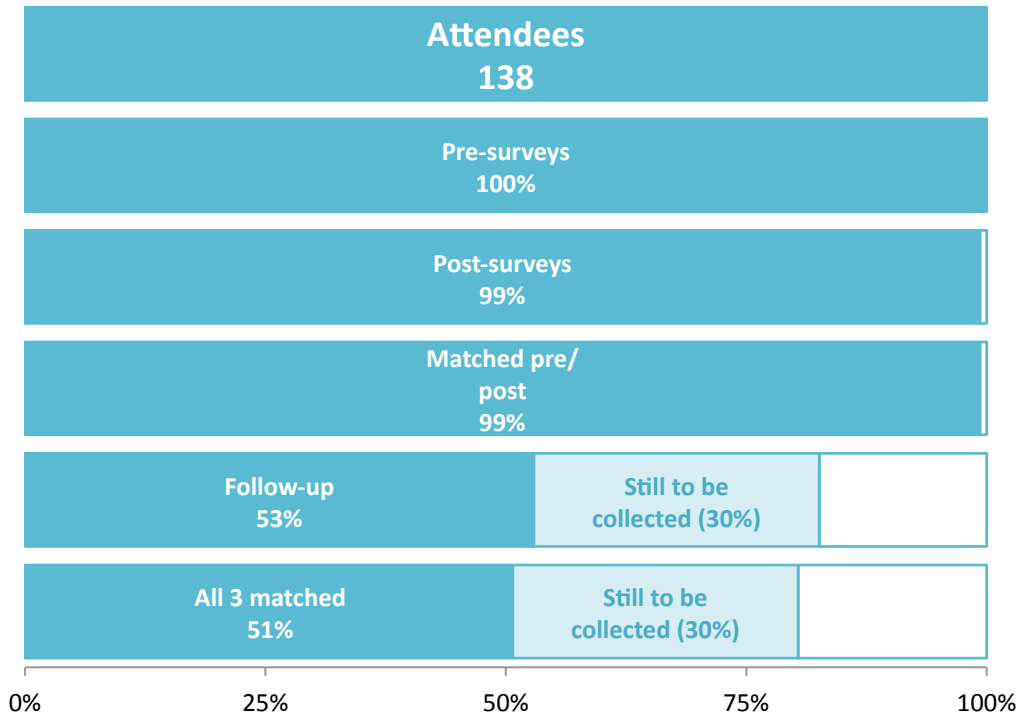
All four workshops were organized into four main types of sessions: (1) Reading sessions - where participants read and discussed research about IBL and active learning, (2) Video sessions - where participants watched and analyzed IBL classes, (3) Nuts & Bolts sessions - where participants and staff discussed how to structure and run an IBL class, and (4) Course Content sessions - where participants worked in small groups, along with staff guidance, to develop materials to use in their own courses. Throughout the course of the SPIGOT project, organizers used feedback from each workshop to make improvements to the model for the next workshop. Since this report serves as the cumulative report for the SPIGOT workshop, we will highlight the main, data-driven changes made throughout the project and draw attention to key takeaways from the SPIGOT workshop series.

Key data-driven actions organizers took throughout the project:

1) Used experience and evaluation results to identify participants' common concerns about IBL. Targeted discussions and examples to address those concerns, and developed takeaways for participants to create, such as a student buy-in plan.
2) Provided examples of various styles of IBL being used in different contexts so that participants could learn how to adapt IBL to their own classes.
3) Built in discussion prompts and identified takeaways for each session so that time was well-spent and participants were appropriately supported.
4) Provided participants with ongoing support after the workshop through a group listserv. Responded to participant concerns and discussions with relevant resources and advice.

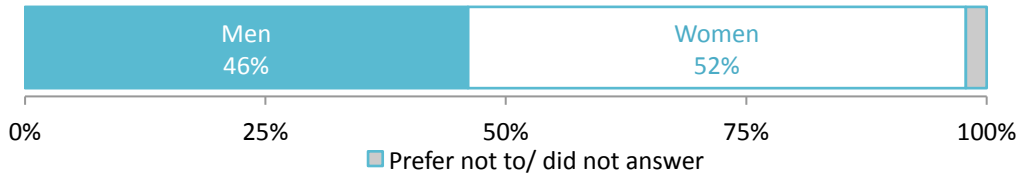
SPIGOT CUMULATIVE
Pre-Workshop Surveys

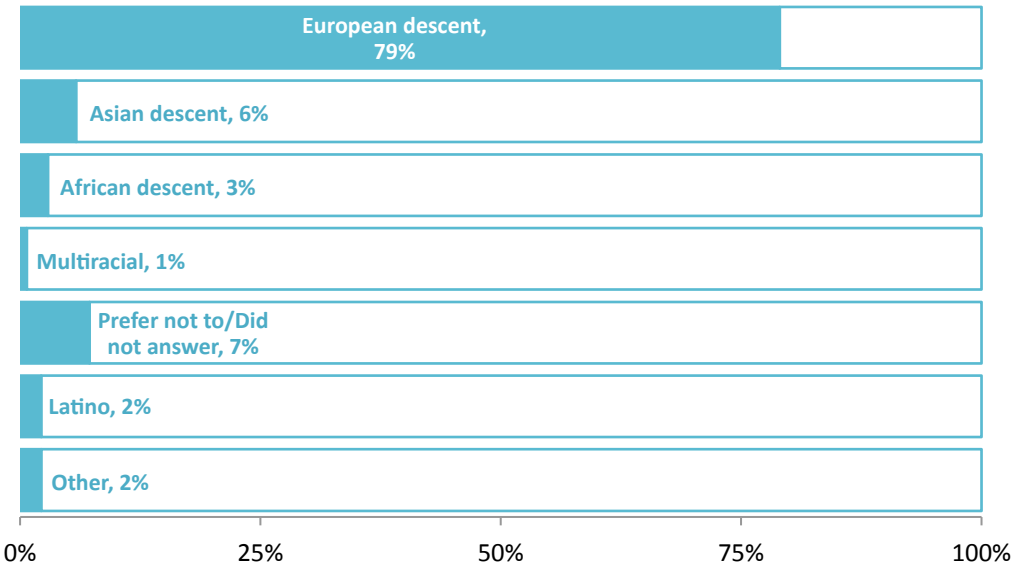
Attendance and Survey Response Rates



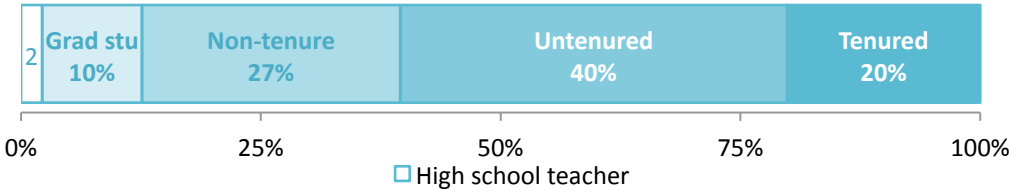
Follow-up surveys cannot be collected for the 2015 workshop until the Fall of 2016. If all participants respond to the follow-up surveys, the project totals for follow-up surveys can be as high as 83% and matched surveys may be as high as 81%. If rates stay the same as the first three workshops, the follow-up response rate will be 75% and the matched surveys will be 72%.

Demographics

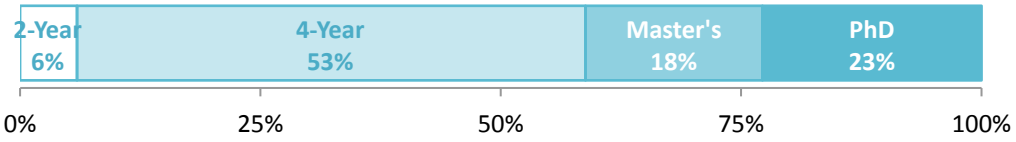




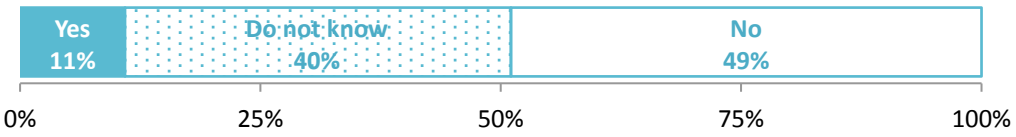
Appointment



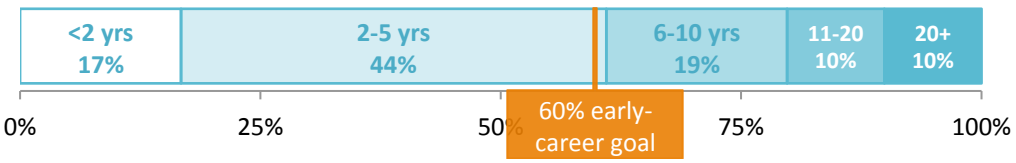
Institution type



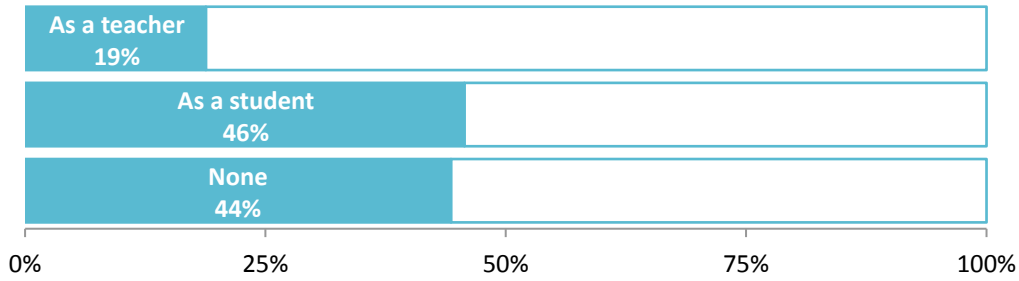
Minority-serving institution



Teaching experience



Previous experience with IBL



Overall, the SPIGOT project met its attendance goals. The workshops served 138 participants, which is 18 more than the original goal of 120. The project also aimed for at least 60% of participants to be early-career faculty. In fact, 61% of faculty were in the first 5 years of their teaching careers. It is remarkable that 100% of participants completed the workshop pre-surveys and 99% completed the post-surveys. Response rates this high are almost unheard of.

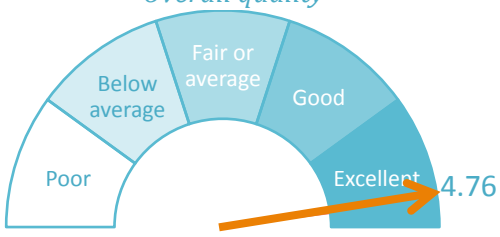
While participants did come with some prior knowledge and experience of IBL both as teachers and students, the teaching practices they reported using were largely traditional and instructor-centered (data will be presented later in the report). The results from these workshops show us what is possible with professional development for interested and willing volunteers. Experience seems to show that the supply of interested and willing volunteers is far from being exhausted, and the need for these workshops is still high. The lessons learned here can also be leveraged to help provide successful professional development in other contexts.

Post-Workshop Surveys

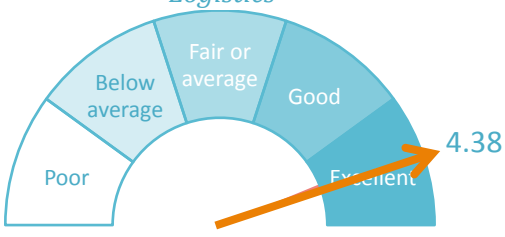
Bulleted lists in this section are from open-ended prompts. They list the most frequent responses and the number of participants (in parentheses) who mentioned each item.

Quality of the Workshop

Overall quality



Logistics



The most common reason participants gave for the high ratings of workshop quality and logistics related to the schedule. Participants appreciated that staff stuck to the schedule and provided many breaks. Participants mentioned that they had time to process what they were learning, especially by revisiting ideas over the course of the workshop. In total, 51 participants made comments about the schedule. By comparison, the next most commonly mentioned topic was the food, about which 25 participants made comments.

Workshop as a Learning Experience

Best aspects	*Needs improvement*
• Helpful & approachable staff (53) • Chance to discuss with staff/peers (47) • Videos/seeing IBL in action (49)	*See note below.*

Throughout all of the workshops, participants identified the same aspects as being the best aspects; namely, the helpful staff, the open discussions, and the examples of IBL in action during the video sessions. These features should continue in future workshops.

Participants identified different areas needing improvement for each workshop, and each time, the staff responded by improving those areas. By the final workshop, the only consensus on needed improvements was that participants wanted more - more examples, more videos, and more time. Overall, this is very encouraging. It suggests the workshop model has been finely tuned and is ready for propagation.

Each year, staff learned some important lessons from participant feedback. We identify them below as a record of the learning and improvements so that these elements may be replicated in future workshops:

- Logistics: Care should be taken to make sure that the room(s) are big enough for participants to comfortably engage with each other and move around. Audio and visual should be clear. Information about resources including wi-fi, housing, and dining should be clear and easily available. Access to resources should be trouble free.
- Full group discussions: Workshop staff should be mindful of the frequency with which they talk during discussions. Staff should aim to minimize their own participation in order to encourage workshop participants to be active in the discussions.
- Small group discussions: Staff should be mindful of how many groups are asked to report back to the full group. There should be enough so that valuable ideas are shared and participants are given an opportunity for their ideas to be heard, but not so much sharing as to become tedious with repetition.
- Modeling: Staff should use workshop time to model examples of good classroom strategies for managing and encouraging participation, presentations, and discussions.
- Scaffolding: Work sessions and discussions should each have an identified goal or takeaway to help focus participants' effort. The level of scaffolding can decrease over time as participants become more independent.
- Nuts & Bolts: As most participants are new to IBL, Nuts & Bolts sessions are particularly useful to provide participants with specific IBL strategies and techniques, such as how to develop inquiry-based problem sequences, how to manage and assess student presentations, and how to develop a grading scheme that encourages student engagement with the IBL structure. It is also helpful to provide examples of syllabi and course notes from IBL classes so that participants can use these as example to help develop their own courses.

Concerns About Implementing IBL

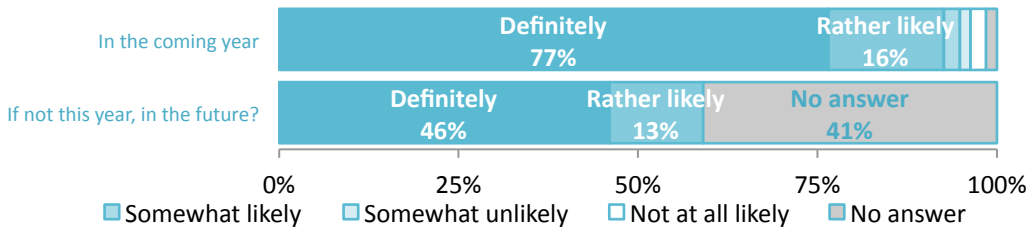
Participants shared concerns on both pre- and post-workshop surveys. Raised concerned were mentioned on post- but not pre-, Dispelled concerns were mentioned on pre- but not post-, and Lingering were mentioned on both.

Concern	*Raised*	*Dispelled*	*Lingering*
• Lack of skill to implement IBL	33	13	16
• Student resistance to IBL	28	29	32
• Harder to cover material	14	24	15
• Increased time/workload	23	13	5
Totals	*98*	*79*	*68*

For each workshop, we compared participants' reported concerns before and after the workshop. These concerns can be indicative of participants learning in different ways. For example, concerns may be *raised* as participants become more familiar with IBL or concerns may be *dispelled* if the workshop helps them to overcome the concern. On the whole, patterns in the frequencies of concerns remained relatively stable over the four workshops and reveal topics that all workshops should address:

- Lack of skill to implement IBL: The instructor skillset needed for an IBL class is different than in a lecture class. Participants need to learn the skills of an IBL instructor and they should be provided with IBL-specific classroom strategies and 'Nuts & Bolts.'
- Student resistance: Participants need to develop a pro-active strategy to introduce IBL methods to students and get students to 'buy in' to the methods. IBL may be new to many students and may seem more difficult than taking notes in a traditional lecture-based class, so instructors need to help students understand why they are using IBL and how it can benefit students.
- Coverage: IBL can often move at a slower pace than lecture classes, so participants will likely be worried about being able to cover all of the required topics. Workshop staff should address this issue and discuss it frequently with participants.

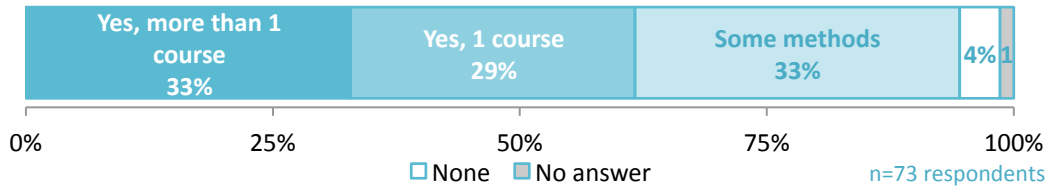
Plans for Implementing IBL

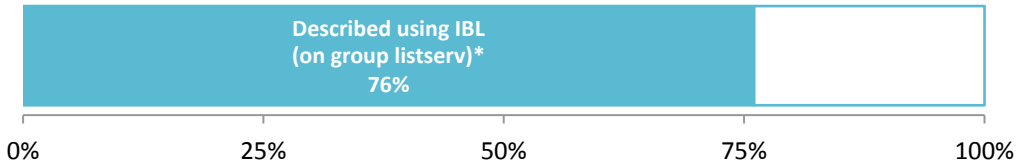


Follow-Up Survey Outcomes

Results shared throughout this section are only for the current follow-up survey respondents (73 of 97, 75%), 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. Additionally, the 41 participants from the 2015 workshop will not receive their follow-up surveys until the Fall of 2016, and are therefore not included in this section.

Implementation





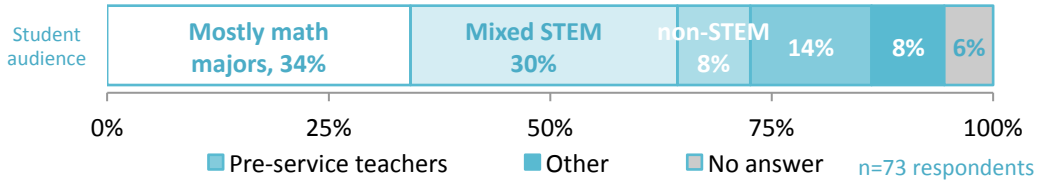
*n=97 participants

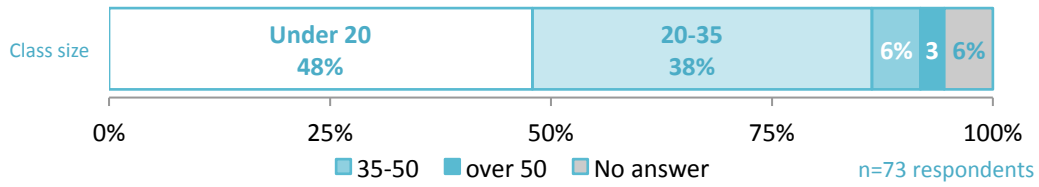
Spreading IBL to:

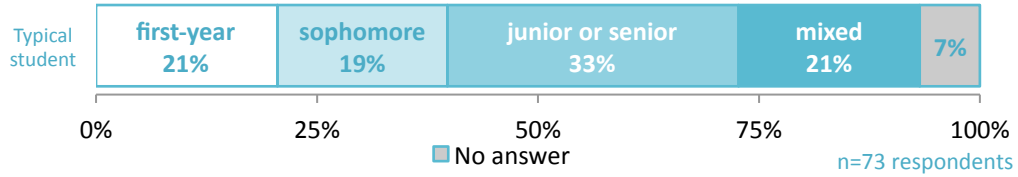
180+ classes

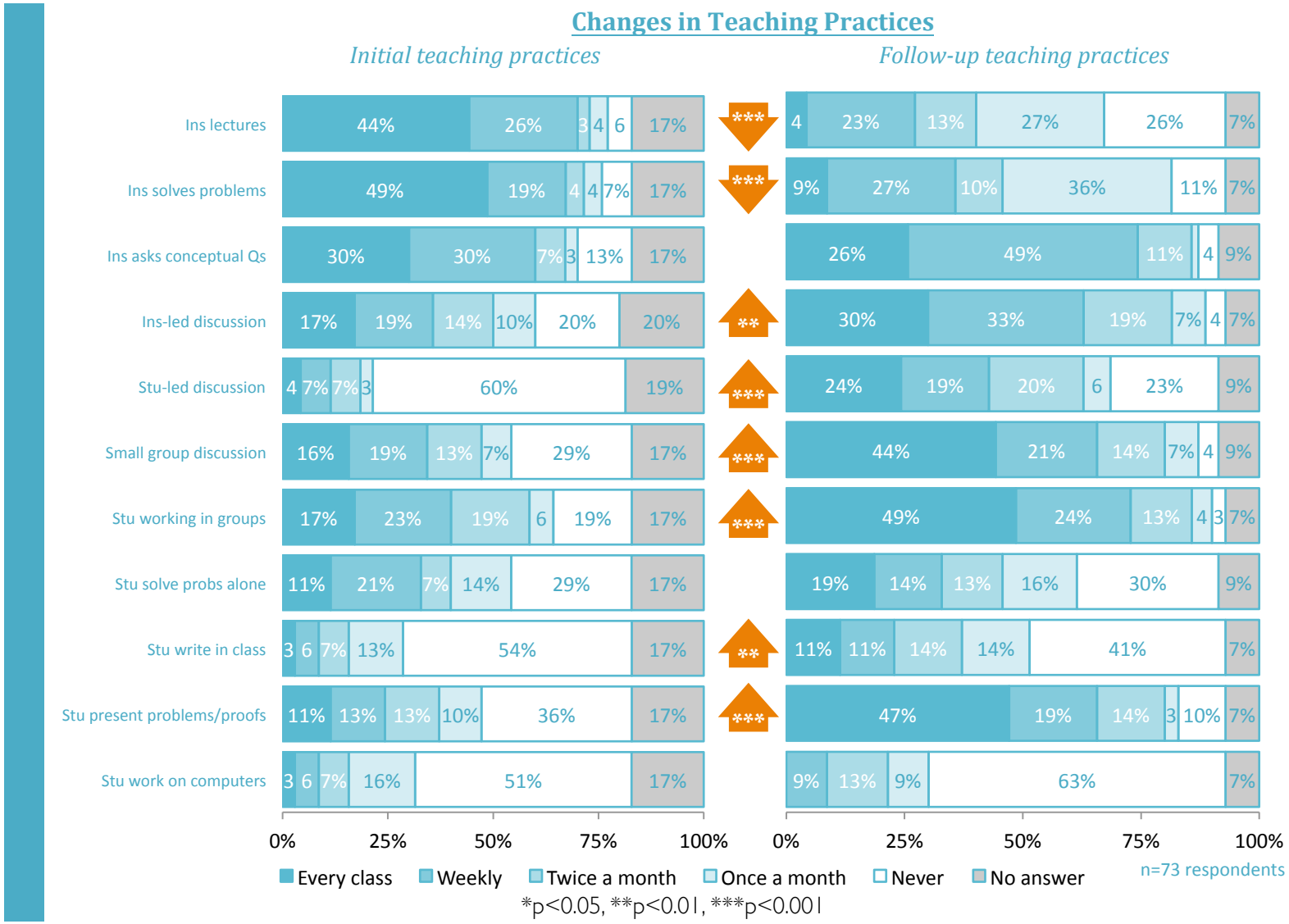
4600+ students

in the first year following the workshop.








Changes in Teaching Practices
Initial teaching practices
Follow-up teaching practices
Ins lectures
Ins solves problems
Ins asks conceptual Qs
Ins-led discussion
Stu-led discussion
Small group discussion
Stu working in groups
Stu solve probs alone
Stu write in class
Stu present problems/proofs
Stu work on computers
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***
***
***
**
***
0%
25%
50%
75%
100%
Every class
Weekly
Twice a month
Once a month
Never
No answer
n=73 respondents
*p<0.05, **p<0.01, ***p<0.001

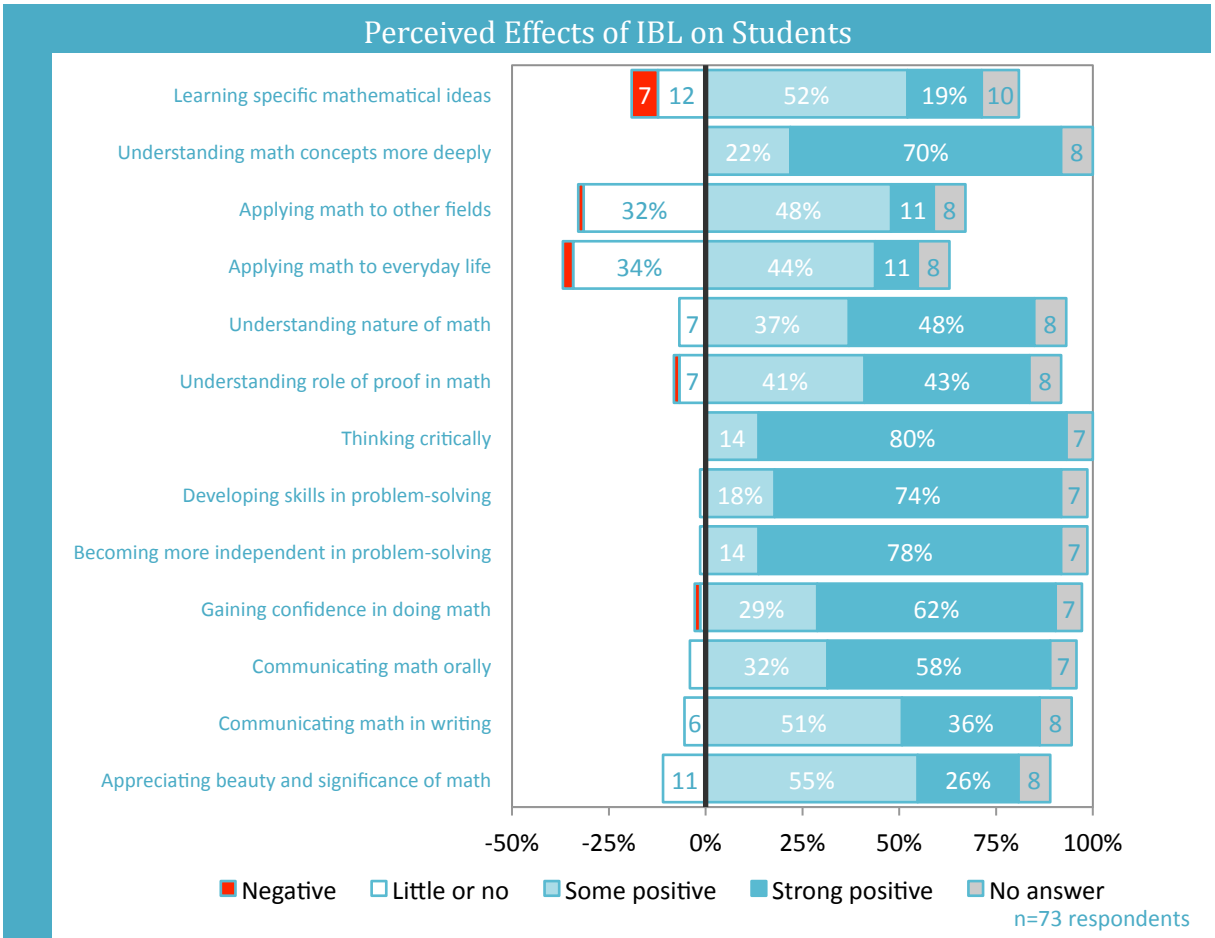
Of those who responded to the follow-up surveys, 95% reported implementing at least some IBL methods. Overall, this means at least 71% of the 97 participants from the first three workshops have implemented some IBL in the year following the workshop. We also analyzed listserv traffic for these three workshops to measure implementation. In total, 90% of all participants from the first three workshops were active on the listserv, and 76% of all participants made comments indicating that they were implementing IBL.

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, individual writing in class, and student presentations.

The instructors who did implement IBL have exposed over 4600 students to IBL methods in over 180 classes in just the first year after the workshop. Participants are now in their second or third academic years following the workshops, so the impact is likely now even greater. While most participants tended to use IBL in smaller classes of 35 students or less (86% of respondents) for upper-level (54%) math and STEM majors (64%), there were instructors who reported using IBL in a wide variety of classes including pre-service teacher courses, non-math-major courses, and first-year courses.

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 73 follow-up 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.



Greatest student benefit (58 respondents, 90 coded topics)

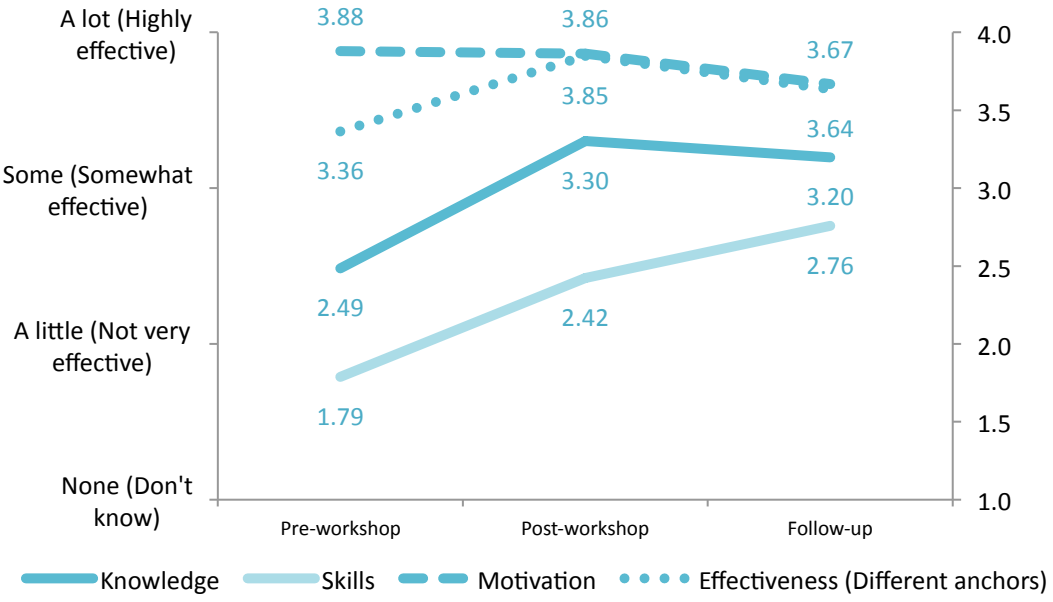
- Deeper mathematical understanding (23)
- Independence (17)
- Behave like mathematicians/ do real mathematics (14)
- Improved confidence (13)

Concerns about what students may NOT gain (56 respondents, 59 coded topics)

- Coverage/exposure to certain topics (24)
- Students don't completely buy in and benefit from IBL method (8)
- Students are too independent (can't judge correctness, don't learn formal names/procedures, etc.) (8)

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 across the workshops, coverage remained as the highest ongoing concern for participants. Participants perceived some of the weakest effects on applying math to everyday life and to other fields.

Perspectives on IBL



Overall, patterns in participants' reported knowledge, skills, motivation, and belief in the effectiveness of IBL were highly consistent across the workshops. 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 slightly after implementing it in their own classrooms, it still remained almost at the very top of the scale. Participants entered the workshops feeling IBL was an effective teaching method. Their beliefs in its effectiveness increased after the workshop, but then dropped slightly 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 Workshops

Most useful aspect of workshop for implementing IBL (61 respondents, 89 coded topics)

- Video sessions (22)
- Examples of how to do IBL, learning specific strategies (16)
- Planning time (14)
- Experienced staff to share ideas (12)

Use of materials participants developed at the workshop (60 respondents, 72 coded topics)

- Used materials to teach IBL course (24)
- Used selected activities (18)
- Did not use the materials (13)
- Plan to use in the future (11)

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. The video sessions in particular seem to be very helpful. Participants also valued the wealth of examples of IBL strategies shared at the workshops, and found the afternoon content planning time helpful to start incoporating their learning into plans for their own courses. In fact, many participants reported using the materials they developed at the workshop.

At the first workshop, participants most frequently identified the staff as the most helpful aspect of the workshop. However, participants from later workshops 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.

Implementation of IBL

Personal gains for instructors (54 respondents, 72 coded topics)

- Helped me be a better teacher/understand student thinking (32)
- More enjoyable way to teach (16)
- Better relationships with students (12)
- Improved instructor's own mathematical ability (7)

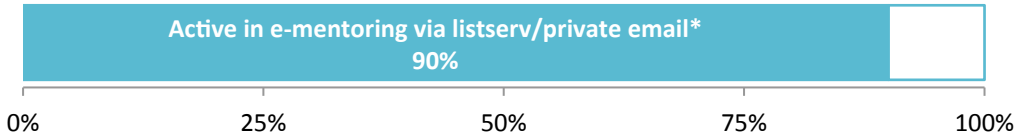
Problems experienced (59 respondents, 79 coded topics)

- Student resistance (36)
- Implementing IBL is challenging (e.g. managing group work & presentations) (13)
- Coverage/exposure to certain topics (12)

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: student resistance, the difficulty of implementing IBL, and coverage. These continue to be challenges for instructors, but on the whole, did not stop them from using IBL methods. In fact, despite 36 participants who reported they experienced problems with student resistance, only 8 reported that it was still a concern. This suggests that participants anticipated and felt equipped to deal with student resistance. Ongoing support should continue to provide advice and resources to help participants manage these challenges and improve their skills as IBL instructors.

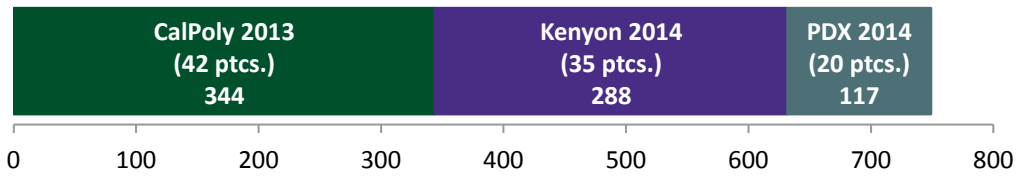
Ongoing Support

Workshop Resources

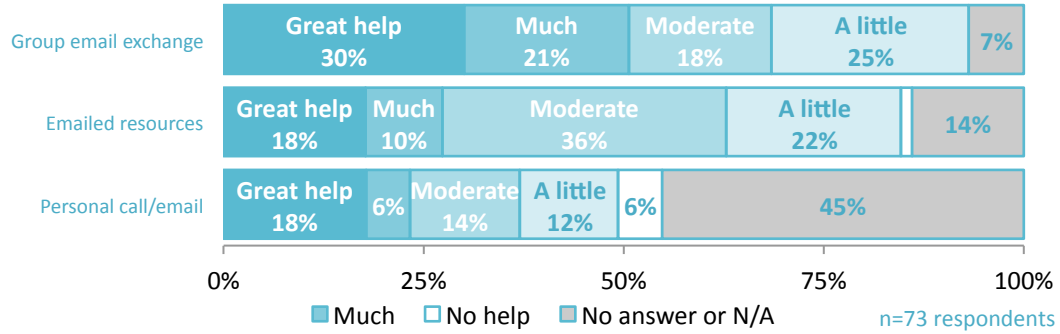


*n=97 participants

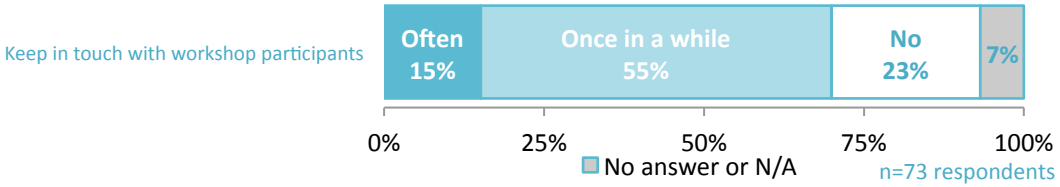
Group listserv messages in one year following workshop



Helpfulness of e-mentoring activities

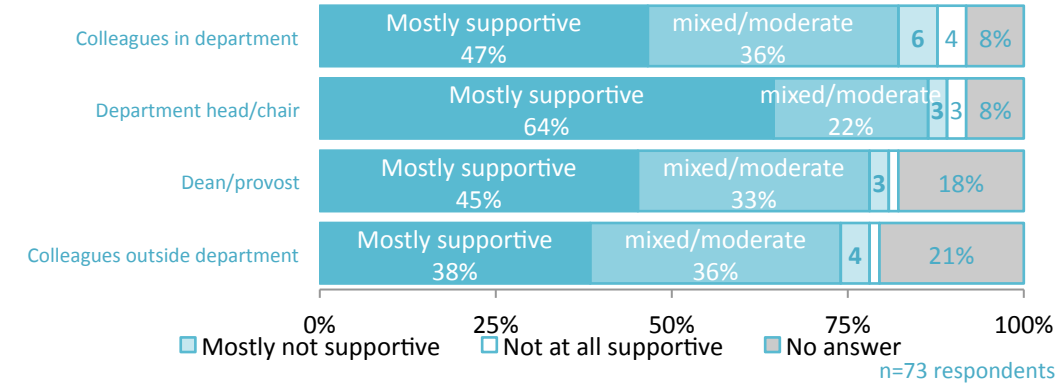


n=73 respondents



n=73 respondents

Institutional Support



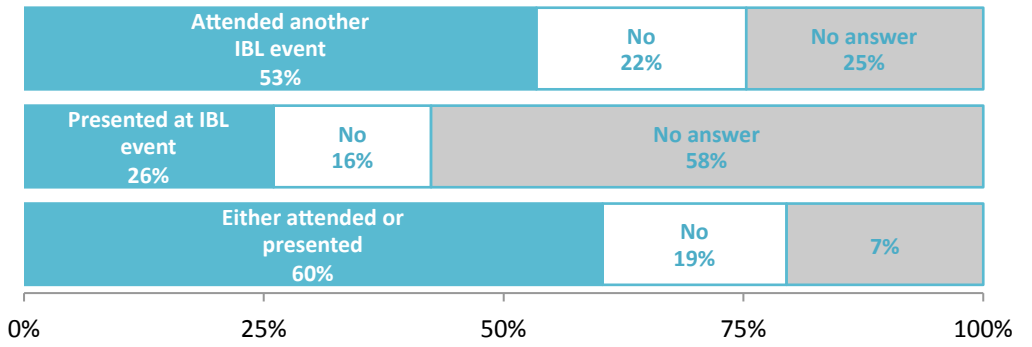
n=73 respondents

Descriptions of departmental/institutional IBL support (47 respondents, 52 coded topics)

- Encouragement - other instructors use IBL or financial support/resources (24)
- Freedom to 'do what I want' (14)
- Doubtful or discouraging colleagues (7)

Other IBL Supports

IBL events



n=73 respondents

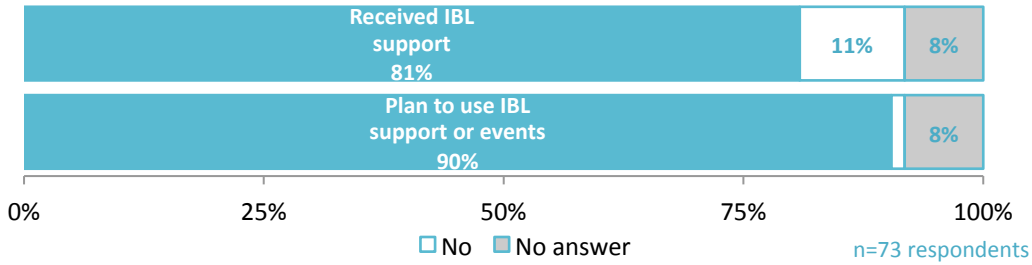
Attended

- IBL sessions at JMM (21)
- IBL session at MAA meeting (17)
- Legacy of R.L. Moore/IBL Conference (13)
- IBL booth at MathFest (12)
- IBL session at MathFest (3)
- IBL poster at MathFest (7)
- Other (4)

Presented

- IBL sessions at JMM (8)
- Legacy of R.L. Moore/IBL Conference (7)
- IBL session at MAA meeting (6)
- IBL booth at MathFest (6)
- IBL poster at MathFest (5)
- IBL session at MathFest (2)
- Other (0)

Use of IBL supports



n=73 respondents

Supports used

- Read workshop listserv (54)
- Contributed to listserv (34)
- Used notes from JIBLM (24)
- Received AIBL minigrant (11)
- Used AIBL mentor program (8)
- Applied for AIBL minigrant but did not receive (4)

Supports plan to use in the future

- Will use notes from JIBLM (43)
- Will read workshop listserv (52)
- Will attend Legacy of R.L. Moore/IBL Conference (40)
- Will attend IBL session at JMM (41)
- Will contribute to listserv (36)
- Will apply for AIBL minigrant (33)
- Will attend IBL session at MAA (32)
- Will submit notes to JIBLM (25)
- Will attend IBL session at MathFest (29)
- Will use AIBL mentor program (16)
- AIBL visiting speaker's bureau (4)

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.

Despite participants expressing concern over departmental or institutional skepticism about IBL, many reported feeling supported by their colleagues, department chairs, and deans. This may indicate that the wider perception of IBL is improving and acceptance and support for it are growing.

Conclusion

Results from the follow-up surveys help to learn about the impact of the workshop on participants' teaching practices. At least 71% of all workshop participants reported using at least some IBL methods in the year following the workshop. In total, participants have spread IBL methods to over 4600 students in more than 180 courses in just the first year following the workshop.

In our previous work on IBL workshops, we identified 5 key features that help participants to implement IBL in their own classrooms. These included:

(1) 'Big tent,' inclusive definitions of IBL - a variety of styles allows for individual instructors to find one that is comfortable
(2) Examples of IBL in diverse contexts - diverse examples allow participants to learn how to best tailor IBL to be successful in their own context
(3) Time - the longer duration of the workshop allows time for participants to revisit and process learning
(4) Common concerns - discuss and provide strategies for dealing with participants' most common concerns: coverage, student resistance, and lack of skill to implement
(5) Ongoing support - support helps participant to implement IBL successfully

The SPIGOT workshop model incorporated all five of these features in numerous ways throughout its design, which likely contributed to the strong implementation outcomes participants reported. Beyond incorporating these features of previous workshops, SPIGOT also improved upon them. For example, organizers developed detailed strategies for helping participants to develop their own action plans for proactively addressing student resistance. The model has been finely tuned and all evaluation results show that it is ready to be taught to and implemented by other faculty developers.

Where SPIGOT has really improved our knowledge of professional development is in the importance of ongoing support. Other workshop projects have aimed to incorporate ongoing support, but not to the extent that SPIGOT did. The ongoing support is a critical feature of the SPIGOT model, and may be the reason SPIGOT's implementation rates are even higher than those from previous projects. We are currently engaged in a more detailed analysis of activity from the listservs in order to better understand this component and how it functions to support participants.

Additionally, the SPIGOT project has carefully measured participants' uses of other forms of IBL support, such as IBL-themed conferences, Academy of Inquiry-Based Learning programs, and community resources like JIBLM. From the evaluation, it is evident that these instructors new to IBL methods took advantage of many of the resources available. While the workshops seem particularly effective for providing the necessary push to 'get over the hump' to implement IBL initially, the other community resources help to sustain that use over time and enhance instructors' skills and successes even further. No one resource met all participants' needs. Moreover, many participants reported using multiple resources, possibly to address different needs. Therefore, to support new IBL users and solidify their efforts to incorporate IBL into their teaching, it is essential that the suite of resources within the IBL community remain intact.

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