

# Assessment of Mudd Design Workshops III and V–VIII

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## **Abstract**

This report details and elaborates the assessments conducted at five of the eight Mudd Design Workshops (MDW): III (2001), V (2005), VI (2007), VII (2009) and VIII (2011). The assessments were generally positive overall, and the trend line over the recorded history was uniformly upward. The main negative critique from participants in MDW III was that the amount of time for each presentation had not been made sufficiently clear to participants beforehand. However, the data of the succeeding four MDWs showed increasingly positive results, particularly in areas that stressed pre-workshop communication. The workshops MDW VI–VIII each showed overwhelmingly positive results in the dimensions of organization, facilities, meals, discussion and presentations. In addition to the numerical data, additional comments were solicited from survey respondents and these yield several insightful ideas to be considered in future—and perhaps similar—Mudd Design Workshops.

**Key Words:** Mudd Design Workshops, assessment, Harvey Mudd College.

## **I. Introduction: A Brief History of the MDW Series**

In 1997, the Center for Design Education of Harvey Mudd College’s Department of Engineering held a workshop that was designed in some measure to bring professionals to the HMC campus to help Engineering think through its future computational needs. The initial workshop turned out to be sufficiently successful that a biennial series of Mudd Design Workshops was thereafter begun, although it is interesting to note that the initial core “vision” was not based on a specific topic or set of contents.

Rather, the chair of each of the first eight MDWs had in mind only that HMC should bring together design educators, practitioners and researchers to provide a forum that would become as well known as the Pugwash arms control meetings during the Cold War. Thus the initial “vision,” to the extent one that could be articulated, was process oriented, with a rather general content orientation, that is, the HMC forums would focus on issues in design and engineering education. Even the process orientation was somewhat vague, as the initial invited participants were chosen as people known to the HMC organizers as visible and reputable colleagues in design generally, rather than for specific expertise in design methods, design research or education research.

The MDWs have since become a highly desirable meeting place for engineering faculty, with important intellectual content on a variety of topics in engineering design education. The themes, dates and registration totals of the eight MDW are:

- Computing Futures of Engineering Design, 1997, 47 participants
- Designing Design Education for the 21st Century, 1999, 57 participants
- Social Dimensions of Engineering Design, 2001, 57 participants
- Designing Engineering Education, 2003, 44 participants
- Learning and Engineering Design, 2005, 63 participants
- Design and Engineering Education in a Flat World, 2007, 53 participants
- Sustaining Sustainable Design, 2009, 57 participants
- Design Education: Innovation and Entrepreneurship, 2011, 85 participants

The Workshops were organized by a series of Advisory/Organizing Committees that have drawn a variety of leading engineering educators, including for 2007, 2009 and 2011: Clive L. Dym, *Harvey Mudd College* (Chair); Alice Merner Agogino, *University of California, Berkeley*; Aaron Altman, *University of Dayton*; Cindy J. Atman, *University of Washington*; J. Edward Colgate, *Northwestern University*; Philip E. Doepker, *University of Dayton*; Daniel D. Frey, *Massachusetts Institute of Technology* and *Singapore University of Technology and Design*; Peter Gregson, *Dalhousie University*; Ahmad Ibrahim, *Yorkville University*; John S. Lamancusa, *Pennsylvania State University*; Larry J. Leifer, *Stanford University*, Chris L. Magee, *Massachusetts Institute of Technology* and *Singapore University of Technology and Design*; Gregory B. Olson, *Northwestern University*; John W. Prados, *University of Tennessee, Knoxville*; Sheri D. Sheppard, *Stanford University*; Janis P. Terpenney, *Virginia Polytechnic Institute and State University*; and John W. Wesner, *Carnegie Mellon University*.

The early MDWs were supported by Harvey Mudd College and a few industrial partners: Boeing, Hughes and Raytheon. The MDWs have since become largely self-supporting, perhaps an indication that the MDW series is regarded as a worthwhile investment in the increasingly vast free market of conferences and meetings. Ironically, a 2001 proposal to the NSF was rejected in part because the series of workshops was regarded as “too successful” to warrant further support—although it must be noted that the NSF did provide some support for MDW III (2001) and greater support for MDW VIII. As a result of that support, MDW VIII offered ten “travel fellowships” to registrants from under-represented groups and minority-serving institutions, an “MDW Community” web site was built [1] and this assessment report was prepared.

MDW participants represent a wide range of U.S. engineering schools, including Arizona, ASU, BYU, CMU, Clemson, Cornell, Dayton, George Mason, Georgia Tech, Idaho, MIT, Marquette, Minnesota, Missouri, Northwestern, Ohio State, Olin, Penn

State, Pittsburgh, RPI, Smith, Stanford, Tennessee, Texas A & M, Texas Tech, Tulane, USC, Utah State, Villanova, Virginia Tech, Washington, West Virginia and Yale. Overseas participants have also been plentiful, representing Aalborg (Denmark), Budapest University for Technology and Economics, Dalhousie University, Hong Kong U of Science and Technology, Institutt for Informatikk (Oslo), ITESM Mexico, KAIST (South Korea), Maastricht, Singapore Polytechnic, Singapore Institute of technology and Design (SUTD), Technion–Israel Institute of Technology, Technical University of Berlin, Technical University at Delft, Technical University of Denmark, Technical University of Lisbon, Tel Aviv, Universidad Politécnic de Valencia and University of Queensland. Practitioners have come to the MDWs from Attenex, Boeing, Dudek, IDEO, Lucent, Northrop and Sapient. The MDW audiences have generally included about 60% repeat registrants from previous workshops, with the balance being “first timers.”

Recent MDW keynote speakers have included: William A. Wulf, then-president of the National Academy of Engineering (2003); James W. Pellegrino, Distinguished Professor of Psychology and Education at the University of Illinois at Chicago (2005); Chris Scolese, Chief Engineer of NASA (2007); Malcolm Lewis, President of Constructive Technologies Group (2009); and jointly in 2011, Professors Alice Merner Agogino of Berkeley and Larry J. Leifer of Stanford. Featured banquet speakers have included presidents of two emerging institutions who introduced the MDW community to their new endeavors: Richard K. Miller talked about Olin College in 1999, and Thomas L. Magnanti described the Singapore University of Technology and Design in 2011.

Proceedings of the Workshops have appeared as special issues in *Artificial Intelligence for Engineering Design, Analysis and Manufacturing* (MDW I) [2] and in the *International Journal of Engineering Education* (MDW II–VIII) [3-9].

Finally, post-workshop assessments for MDW III–VII were done by a subcommittee of the Organizing and Advisory Committees, with participant respondents finding almost universally that the workshops provided important intellectual content on design pedagogy and “creating a vibrant community” of design educators and design practitioners. The details and implications of these assessments make up the balance of this report.

## II. Assessment Methodology

The workshop assessments were conducted in different formats over the years. The first assessment, conducted in 2001 after MDW III, was a 21 question multiple-choice survey. However, that multiple-choice survey was augmented for the remaining MDWs, with three questions pertaining to the review of potential journal papers added, bringing the total to 24 questions.

Starting just after MDW V in 2005, a second component was created, consisting of 14 open-ended questions. The number of such open-ended questions increased to 15 after

MDW VII and to 17 after MDW VIII. These new questions, which are detailed in Appendix I, pertain to the review of academic papers, unique workshop themes and the MDW online community. Representative comments and suggestions for future MDWs are given in Appendix II.

Following MDW VIII, the assessment survey was performed online for the first time: each of the prior assessments had been conducted by electronic mail. The MDW VIII online assessment drew the highest number and the second highest percentage of responses (62.4% of participants) of any of the MDWs, thanks in part to the online nature of the survey.

### **III. Assessment Results and Outcomes**

The most prevalent recurring theme from the assessment surveys is continuous praise from participants for the work done by the MDW Advisory/Organizing Committees to better the Workshop each year. The number of survey responses received also increased with each passing MDW. The numerical data deriving from the multiple-choice questions are shown in Tables 1 and 2, and the key points from each assessment survey follow afterward.

The MDW III assessment produced 28 responses to the 21-question multiple choice assessment survey. The overall response was positive, with one of the few critiques from respondents being that the presentations' time limits were not more clearly communicated beforehand.

The MDW V assessment produced 31 responses to the assessment survey, comprised of 24 multiple choice and 14 open-ended questions. Once again, the overall response from participants was quite positive, although some participants suggested that greater MDW marketing efforts might be made.

The MDW VI assessment produced 33 responses to the assessment survey, comprised of 24 multiple choice and 14 open-ended questions. The statistical responses increased positively across the board after MDW VI. The most notable takeaway in this assessment was that future MDWs should not be moved to an alternate site: the resounding response was that they should stay at Harvey Mudd.

The MDW VII assessment produced 40 responses to the assessment survey, comprised of 24 multiple choice and 15 open-ended questions. Once again the respondents unanimously responded positively. When asked if future MDWs should be held in even-numbered years to avoid conflicting with the biennial ICED meetings, the respondents indicated that the current scheduling is just fine.

The MDW VIII assessment produced 53 responses to the assessment survey, comprised of 24 multiple choice and 17 open-ended questions. Even though this was most heavily attended MDW ever, with 85 participants, respondents applauded the fact that the discussion and interaction at each of the sessions remained as lively and rigorous as

before. Additionally, when asked they want to see in an MDW Workshop official website, respondents responded affirmatively, stressing the importance of an interactive design where discussion could be further continued.

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Question	MDW III	MDW V	MDW VI	MDW VII	MDW VIII	Average	St. Dev
1. I was given enough notice (time) to plan a presentation and/or plan to attend.	4.63	4.52	4.71	4.83	4.67	4.67	0.11
2. Requirements for paper format were adequately communicated.	4.48	4.29	4.28	4.88	4.41	4.47	0.25
3. The time allotted and format for my presentation was made clear before the workshop.	3.00	4.19	4.52	4.71	4.77	4.24	0.73
4. Registration processes were adequately communicated.	4.79	4.10	4.48	4.63	4.60	4.52	0.26
5. Housing and transportation options were made clear to participants.	4.73	4.43	4.61	4.72	4.76	4.65	0.14
6. Facilities for the workshop were excellent.	4.64	4.52	4.61	4.73	4.37	4.57	0.13
7. Organization and format of the sessions optimized the information presented.	4.34	4.30	4.67	4.49	4.00	4.36	0.25
8. Adequate time was provided for each author to present her/his paper.	3.48	4.23	4.45	4.33	4.14	4.13	0.38
9. Adequate time was given for dialogue during a session to enhance my ability to understand the material.	4.11	4.43	4.91	4.73	4.25	4.49	0.33
10. The time provide for open discussion was sufficient.	4.07	4.43	4.91	4.69	4.18	4.46	0.35
11. Meals and breaks were appealing.	4.82	4.55	4.52	4.68	4.68	4.65	0.12
12. Breaks between sessions should be expanded to promote reflection and dialogue among participants.	3.41	3.61	3.45	3.25	3.47	3.44	0.13

Table 1. Cumulative assessment survey results for MDWs III and V–VIII for the twelve questions concerned with logistics and organization. Scoring for each question was on a five-point range where a score of 1 indicates *strong disagreement* and a score of 5 indicates *strongly agreement*.

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Question	MDW III	MDW V	MDW VI	MDW VII	MDW VIII	Average	St. Dev
13. All presentations met the objectives and theme of the workshop.	3.63	3.81	3.94	4.00	3.76	3.83	0.15
14. I would like to have received the completed papers at the conference to better follow the presentations.	3.58	3.57	3.70	2.97	2.72	3.31	0.43
15. Future conferences should be held at alternate sites for every-other conference.	3.62	3.10	2.75	2.54	2.60	2.92	0.44
16. Marketing and visibility should be expanded to increase the attendance at this workshop.	3.62	3.23	3.09	3.08	2.52	3.11	0.39
17. More non-author participants should be encouraged to attend this workshop.	4.00	3.39	3.45	3.20	2.88	3.38	0.41
18. The Thursday-Friday-Saturday format was convenient and effective.	4.39	4.52	4.10	4.20	3.80	4.20	0.28
19. The MUDD Workshops should be held in "even-numbered" years to avoid a conflict with the International Conference on Engineering Design (ICED) conferences.	3.89	3.37	3.07	3.09	3.10	3.30	0.35
20. The luncheon speaker format worked well.	3.89	4.42	3.97	4.13	3.84	4.05	0.23
21. The after-dinner presentations were appropriate and enhanced the conference.	4.04	4.30	4.29	4.15	3.94	4.14	0.16
22. The format of limiting the formal presentation to 12 minutes for each speaker followed by questions of the panel is effective and appropriate.	N/A	4.33	4.67	4.35	4.02	4.34	0.26
23. All papers at the conference should be peer-reviewed by at least 3 individuals.	N/A	3.94	3.87	3.44	3.78	3.76	0.22
24. If papers are peer-reviewed, each author should be expected to review at least 3 other papers.	N/A	4.23	3.97	3.74	3.67	3.90	0.26

Table 2. Cumulative assessment survey results for MDWs III and V–VIII for the twelve questions concerned with programmatic issues and content. Scoring for each question was on a five-point range where a score of 1 indicates *strong disagreement* and a score of 5 indicates *strong agreement*.

In the additional comments section at the end of each of the surveys, very few “radical” remarks were advanced over the years. For the most part, the added comments offered either praise or constructive suggestions, including: get more speakers and involvement from industry, replace a presentation-discussion session or two with some more interactive or participatory activities, and perhaps add an outside recreational activity.

By way of outcomes, several changes have been made over the span of the eight MDWs, responding both directly and indirectly to the assessments results reported just above. Perhaps the most important change has been the move from the conventional technical meeting paradigm in which most of the time is taken up by presentations, with only short question period at the end of each session. While this was the case for the first MDW, it rather quickly shifted to the current mode in which only one-third of each two hour session (40 minutes) is used for presentations, with the remaining 80 minutes is devoted to moderated audience discussion. As part of this switch in format, the instructions to presenters have become much sharper and clearer to avoid over-preparation and hurt feelings by authors, while allowing ample time for the discussions for which the MDWs have become known.

This aspect of the programming and formatting should be assessed and re-envisioned on a continuing basis as the MDW series continues. There is clear sentiment for having some group design activity as part of the program, whether as an initiator at the beginning of an MDW, or later in a breakout session. There has also been a strong suggestion that some free social time be provided for the MDW registrants, as the interactions and networking that have taken place are regarded as very positive, but there is a desire for still more of that opportunity. Thus, future MDW organizers should continually monitor the competing demands for presentation, group and networking activities and adjust accordingly.

Another major change has been in the venue in which the MDWs have been offered. The early MDWs were held in what was then a rather new, tiered classroom at HMC, in which participants could rather easily swing around to follow discussion by participants to the left and the right, as well as above them in the amphitheater seating (Figure 1).

But when HMC’s new Parsons Design Studio came online in 2007—which was specifically designed as a studio for teaching HMC’s first year design class, E4—the MDWs were moved there as well. In the Parsons studio participants were seated around circular tables, on swivel chairs, typically four persons to a table. This venue change worked out quite well, even when the number of participants reached 85 in MDW VIII, and is an improvement that our participants have noted and appreciated.



Figure 1. Tiered stadium seating in the venue used for the first five MDWs.

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A logistical change made over the MDW series was an evolution in lodging choices offered to the participants. In the earliest days MDW registrants could choose between the nearest Claremont hotel and an HMC dormitory. Both of these choices were less than ideal: the hotel needed to be upgraded and modernized, which it was in the last several years, and the dormitory choices were hindered in part by the evolutionary upgrading of HMC's own dormitory stock and the timing of the MDWs. Since the MDWs came so soon after the end of spring semesters, while increasing numbers of students were staying on campus to do summer research, HMC's facility staff was finding it increasingly difficult to accommodate participants' needs. Thus, in MDW VIII, all of the registrants stayed at a nearby (less than one-half a mile from campus) and recently renovated DoubleTree Inn, and at a very good group rate. This arrangement also seemed to work quite well.



Figure 2. The Parsons Design Studio during MDW VIII, with 85 participants, was also the venue for MDWs VI and VII.

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#### IV. Conclusions and Recommendations

The main lesson learned is that the model of the past eight MDWs works and, in fact, works quite well: The vast majority of the assessment data shows continuing praise from MDW participants. The number of MDW participants has increased during 2005–011 (i.e., during MDWs V–VIII), with the most recent workshop recording the highest total by far.

One indicator of the success of the MDW series is the continuing participation of slowly varying sets of very highly regarded design educators as members of the past advisory/organizing committees. These educators were informally polled as to why they participated, and their collective response was that the MDWs were a place where serious discussion about the present and future of engineering design education could

be discussed, to the mutual benefit both of established senior scholars and of emerging younger faculty and graduate students. Excerpts of some of the individual responses include:

- I have welcomed the opportunity to participate ... because of the advanced expertise and experience of the other organizing-committee members ... to gain experience with designing a conference on design ... because I enjoy working with bright, intelligent people committed to design. I enjoy, and learn from the conversations ... the experience and want to “give back” and to help to inculcate a culture of design in our society.
- Given the incredibly prolific and influential design engineering educators who comprise the organizing committee and additionally who make up regular attendees, what engineering design educator in their right mind would turn down an opportunity to learn from and exchange ideas with the highest per capita density of great minds in the field? Couple this with the format of the workshops that allow for a rich, open, flowing and evolving dialogue on the most topical subjects in the discipline in a variety of different settings and the experience offered by the MDW's is unparalleled.
- I was willing to get involved because the MDWs provide an opportunity for a multi-generational community of academics and industry representatives dedicated to design education to tackle hard, thematic questions about this education.
- The MDWs have had a major impact on how I teach design. I stay involved because of my firm conviction that reformation of design education remains the most important element in the restoration of a technology-based US economy.
- Clive asked me ... the MDWs were well organized and led ... I felt I could provide input and be heard without this being a big “time sink” the return on investment was huge ... the MDWs provided much information that I could apply in my position as coordinator of the design and manufacturing clinic and the teacher of project based learning courses.
- I eagerly contribute time and effort to the MDWs as they provide an ideal opportunity for faculty and students to engage in an intellectual exchange on design education. The time invested in selecting timely topics, organizing sessions and peer-reviewing submissions keeps the quality of the papers and workshop at a high level. The workshop this year was particularly benefitted by the addition of a diverse set of graduate fellows funded by the NSF grant. Their contributions were refreshing and their experience will have a strong developmental value for their career. These students are our future.

Maintaining the traditions and style of the MDW series to this point is the main priority and challenge for the future advisory/organizing committee, and for Harvey Mudd College's next Fletcher Jones Professor of Engineering Design. This requires maintaining strong communication links with the MDW community, providing high

quality facilities and food, sustaining a strong connection with the *International Journal of Engineering Education*, and choosing powerful and engaging MDW themes.

The chair of the first eight MDWs would also point to the following ingredients as essential to ensuring the continued success of the MDW series: a visible and committed organizing/advisory committee; a committed and thoughtful staff; and an equally committed institutional backdrop. For this MDW chair, Harvey Mudd College, and especially its Department of Engineering, have provided both the environment and the platform that contributed mightily to the success of the MDW series.

As successful as the biennial series of Mudd Design Workshops has been so far, it would nonetheless be a mistake to automatically retain the structure and organization without considering any possible changes for each new MDW. Improvements should be considered going forward to ensure that the MDWs remain a premier meeting point for design educators, researchers and practitioners, with greater industry involvement and the inclusion of some more participatory design activities being attractive candidates for further consideration.

## V. Acknowledgments

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## VI. References

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### Appendix I: Open-Ended Survey Questions for MDWs VIII

The list of questions below was used as the open-ended part of the assessment of MDW VIII (2011). They are typical of the kinds of open-ended (i.e., not multiple-choice) questions that have been used for MDWs V–VIII.

1. Why did you choose to attend the Mudd Design Workshop VII?
2. As a result of attending the workshop, what, if anything, are you planning to do differently in your design education curriculum/courses?
3. Are you planning to disseminate what you learned at the workshop to others? If so, please discuss to whom and what you feel is important to share with others.
4. What themes did you see as important and emerging from the workshop that should be explored in future workshops, or which topics would you like to hear more about at the next workshop?
5. As a result of the workshop, did your concepts of what "Sustaining Sustainable Design" change or become clearer? If so, please discuss in what ways this applies.
6. What does *innovation* mean to you?
7. What does *entrepreneurship* mean to you?
8. Do you think this workshop would benefit by representation from a wider variety of engineering and non-engineering disciplines? Which areas should be better represented?
9. Do you have any recommendations on creating wider representation?
10. In what capacity did you attend the workshop (author/presenter, organizer, attendee)?
11. In your opinion what would be the optimum range of participants for this workshop?
12. What would be the maximum number of attendees to retain the "character" of this workshop?

13. Are there advantages to increasing the number of participants at this workshop? If so, what are they?
14. What are your thoughts on having all papers peer-reviewed that are submitted to this workshop?
15. What recommendations would you make to future participants regarding living accommodations?

Please provide any additional reflections, comments, compliments or criticisms below. Be assured that they will be used as input for continuous improvement of this workshop.

### Appendix II: Comments and Suggestions from MDWs V–VIII

The following represent a sampling of some repeated and useful suggestions for future MDWs that were offered by survey respondents after MDWs V–VIII.

<b>Participants' Suggestion for Future MDWs</b>
<p>I would like to have seen more variety in the “open discussion” periods. Whole group discussion perhaps in one or two of the sessions where it makes sense, but they should be mixed up with small group discussion, personal reflections. More time for one-on-one's: networking was one of the most beneficial aspects of the workshop. I don't find the closing exercise (the affinity diagramming) very useful. In place of that, perhaps some personal reflection time; or perhaps a discussion on an agenda for future research that could possibly result in a report to funding agencies.</p>
<p>I loved the workshop format. Be sure to keep at least as much time for discussion as for this one. Grouping of papers in sessions is important. Facilitators varied considerably; some were excellent at getting and keeping discussion going and others were not. Choice of facilitator made a big difference. I also liked the useful folder: it was much better than a bag. I would have liked a bound copy of all the papers during the conference to check results and details as it proceeded. Maybe some activities to work in small groups earlier in the conference would have improved the dynamics throughout. It was a workshop so it's important that people speak with each other. Providing some “formal” activities for groups to get together helps people get to know each other. Structuring these around design is a great way of learning. Any chance of actually getting the people there to design something during the workshop? Exercise our creative minds! I really liked the group affinity diagramming wrap-up session. I like this survey and would be interested in seeing the compiled responses if you get around to sending them out.</p>
<p>The people who came really need to stay through the end. I was disappointed that not more of the participants were willing to make commitment to take actions based upon their workshop experience. This may, however, relate to the presentations, in that there may not have been such clear “opportunities” described. This may in turn, be a result of the theme and/or of the papers that were submitted.</p>