# Makerspaces ITL Final Report
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Jan 2016

This is a final assessment for the Makerspaces and Culture ITL grant.  The assessment follows the model suggested by Lisa Perfetti, Associate Dean of Faculty Development.  We consider the project a great success and are grateful to the College for the funding.  (If there are specific donor names we could mention here Lisa, please feel free to include them)

1. Did recipients complete what they set out to complete?  The originally approved proposal is included at the end of this report.  The originally proposed goals are in Section 3.  They are duplicated here and assessments of each follow:

   a. **To develop a special topics class in the art department that introduces students to programming and electronics with an open-source philosophy. The course will be jointly taught by us (as part of Justin's regular teaching load, as an unpaid overload for Albert).  The hope is, for example, that students in the art department might bring some of these tools to bear in later undergraduate work.**

      *There were 15 students in total for the course , seven women, and eight men. Nearly half of the students were involved were Arts majors (including Theatre) and approximately half were math or science majors.Over the course of the year since the maker class students have been using many of the tools and ideas from the class extensively. The open source philosophy was the most important component in terms of bringing changes into the art department. Students are sharing knowledge and working together in ways that were not seen nearly as extensively before this course. In particular the senior thesis projects last year and this year show a great deal more teamwork, that can be traced back in part to this course. In terms of equipment usage the lasercutter in particular has proven to be the most flexible tool we introduced in the course, allowing students in New Genres, BookArts / Printmaking, and Sculpture to achieve more finely executed work.The class also allowed a more effective introduction of programming in the New Genres course based on a better understanding of how to introduce fundamental coding ideas, while also encouraging students to tactically use code that has been made available through the open source community.*

      *This course is currently scheduled to be taught again next fall. Before then, the Art department is looking into changing the designation from a 200 level course to a 100 level foundations course. While Albert will be unable to co-teach the course Justin has started approaching various faculty from different departments (Music, Computer Science, Physics) to help facilitate individual projects in the course.*

b. **To attend at least one maker-style workshop in Seattle or Portland (where such events happen regularly).**

*We were unable to schedule a visit to a Maker Workshop off campus together, however Justin was able to attend a 3D printing workshop over the preceding Summer in Sewanee, Tennessee taught by Greg Pond. Greg was brought in to lecture and lead a workshop for the Art department in the Spring semester after the Maker Class to reinforce ideas and techniques for students, as well as to introduce new techniques. The class was also brought to the walla Walla foundry for a tour.*

c. **To bring in at least one speaker (Joseph Gray) to hold a one-day maker-style workshop on campus that is open to both students and faculty.**

*Joseph's visit to class and his workshop were well received. The Arduino (microserver) portion was clear and fun, but thus far has not had as much of a consistent influence on students. Two Studio Art Alumni, Ben Lerchin and Logan Theiss, also visited the Maker class to talk about how relevant skills covered in the class are to today's professional art production.In future iterations of the class Justin plans on bringing more guests for short visits and workshops.*

d. **To learn about gender skew in computer science education and some efforts to mitigate the skew. We hope to implement some of what we learn in the special topics course that we offer.**

*One of the most useful means of addressing the skew seemed to be the decision to have students always work in pairs or groups that were mathematically randomized. Working collectively and highlighting a sense of community, in and of itself, really seemed to allow female students to feel comfortable.*
*One of the highpoints of the class was a discussion late in the semester about this talk ( https://vimeo.com/110616469)  that addresses a lack of representation of women and minorities in Maker Culture. There were heated exchanges between a male student who dismissed this notion and several women who saw a very important point being made about values.*

2. What are the products of their efforts in terms of content, format, and public dissemination?

*There is a new awareness of the tools we used in the class (3d printing, Arduino, laser cutter etc).  We are both regularly approached by students and faculty about how to use these tools in their own projects.  Both the geology and physics departments now have 3d printers.*

*The Makerspaces and Culture class will continue and will be a part of the art*

*department's foundational curriculum.*

*Finally, the faculty forum in Sep 2015 was well-received by the faculty and staff in attendance. There have been numerous follow up conversations.*

3. Do any of these have potential long-term positive effects on the curriculum or academic program more generally?

   *As mentioned in point 2, the Makerspaces and Culture class will become a foundations course in the art department. Hence, it will continue to inject enthusiasm for these ideas into students and faculty. We expect that enthusiasm to affect other courses and curricula on campus.*

4. How many students were directly involved or indirectly impacted by the grant?

   *There were 15 students in the class. There were 7 students in Joseph Gray's workshop that were not enrolled in the class.*

   *Finally, many students in the art department, who did not take the course, were positively affected by the ideas and techniques introduced in the class, but we don't have a precise count. Further, it is clear that they learned about these ideas and techniques directly from the students in the class. Because of our focus on networked learning, students from the class acted as teachers and mentors in these new approaches.*

5. Did the project enhance the quality of learning experiences offered to students?

   *The maker culture can be studied in the abstract, but the equipment and materials provided by the grant allowed students to engage in the practice of making. Additionally, the visiting speakers provided the students with perspectives of people in the maker culture both as artist and contractor. As noted in the response to point 4, student engagement was so high that knowledge gained in the course was spread well outside of the confines of the classroom.*

6. What evidence do you have that demonstrates impact on student learning (if applicable)?

   In addition to the the impacts cited in points 3, 4, and 5*, a number of senior art students used ideas and techniques from the Fall class as part of their senior Thesis projects in the Spring.*

7. What were the limitations or failings of this project, and how, in retrospect, might they have been better addressed or remedied?

*The organization of equipment and materials was haphazard.  A dedicated staff member or several student workers tasked with keeping things organized would have been a useful addition to the project.  Similarly, dedicated space for equipment and materials would have been useful.*

*Another, more reliable 3d printer would have helped a great deal.*

*Overall material and equipment costs were higher than anticipated which is another reason we decided not to travel to any maker faires.*

*While Albert and Justin enjoyed working closely together in a sustained manner, the particular collaborative teaching approach used in this class is not really a sustainable model for the College.  In the absence of some way of equitably compensating both instructors for the course, future iterations of the class will be directed by a single instructor and employ a guest lecturer organization.  This suggests the need for the College to develop flexible policies for collaborative teaching.*

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                      Originally Approved Proposal
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1. **Introduction**

   A *makerspace* is a place, either real or virtual, where communities of like-minded individuals can collaborate in creative expression.  Typically such spaces employ software, electronics, and other raw materials with the goal of re-combining them in novel ways.  Ideas are freely shared and built upon.  In these creative spaces, we see the merging of inter-disciplinary skill sets and a philosophy of openness and sharing.

   We hope that through this project, we can develop a makerspace at Whitman College.  Such a space could ultimately be valuable in a number of areas of study already present at the College including, but not limited to, art, math, physics and computer science.  The Fouts Center for the Visual Arts is an ideal space for planting the seeds of this type of work. The  Studio Art department has made recent purchases of a 3D printer and 3D scanner and is researching the purchase of a CNC router.  The Hickman Digital Studio in Fouts has increasingly been used to teach programming, and is attracting an increasing number of students in the Sciences. All of these tools, trends and practices can be found in Makerspaces around the world.  We believe that now is a great time to introduce these ideas to students, faculty, and staff at Whitman.

2. **Proposal**

   We each have a long-standing interest in areas that surround the makerspace phenomenon.  We have a history of working together on these issues.  We co-administered an interdisciplinary seminar on "Computational Thinking" in the Spring 2011.  We continue to co-manage a weekly brown-bag lunch seminar on educational

technology with David Sprunger and Jen Mouat that is open to Whitman faculty and staff.  We embrace open-source and collaborative philosophies.  We see the importance of inter-disciplinary exploration.  We recognize the growing influence of software and electronic hardware in all areas of academia.

What we lack is expertise in some of the technologies that are regularly brought to bear in makerspaces.  In particular, we need to see how others are bringing these tools into the classroom.  We need to get our hands on some of the more commonly used platforms, like Arduino kits, and Raspberry Pi's, and get familiar with them before bringing them into the classroom.  Maker culture replaces the old DIY (Do It Yourself) spirit with one we can refer to as DIT (Do It Together) or DIWO (Do it With Others), so the quick turn around and sharing of expertise and knowledge is part of what we want to both demonstrate and foster in our students.

We also recognize that this subject area (like computer science) is prone to skew along gender lines--attracting more men than women.  We would like to study this issue and attempt to adopt some of the methods of mitigating the gender skew that have been developed in computer science.

Each of us brings specific expertise and interests to this project.  As such, the proposal is feasible and an efficient use of resources.

    a.  *Albert Schueller.*  Several years ago I received an ITL grant to develop a course that taught introductory programming using the Lego Mindstorm robotics kit. Much like the work proposed here, that work involved controlling hardware using software and explored the many unique challenges presented in that kind of work.

        I also regularly teach Ma167, the introductory programming course, using C++. Last year, in the latter third of the semester in my intro programming course, the class switched from C++ to a more graphical style programming language called *Processing*.  The transition was smooth and students enjoyed the richer set of programming options available in Processing.  I learned about Processing from Justin (just one of the many fruits of our association).  Processing and Arduino (the kinds of kits we propose using in this project) are sister projects with very similar syntaxes.

        I have a continuing interest in open-source software.  I have maintained the Linux computers in the MathLab since I arrived on the Whitman campus in 1996.  The lab computers are used in a number of math classes and by a number of faculty. They use open-source, free software almost exclusively.  I understand the power of open-source approaches to projects.  The open-source philosophy underwrites the makerspace milieu.

b.  *Justin Lincoln.* Since my arrival on campus in 2010, I have increasingly incorporated the Processing programming language into my new genres art classes.  My specific area of academic study in new genres is new media, which encompasses the history and practices of new technologies, with a particular focus on how these intersect with critical theory. In the past few years I have focused on the sharing and re-using philosophy engendered in the open-source movement. I also study data visualization and recently completed an ITL grant that supported the incorporation of data visualization into the classroom.  One of the most compelling outcomes of my grant was the finding that we need to give students a firmer foundation in how the computational tools that they often take for granted really work.  A project focusing on Makerspaces can help build this foundation and allow students to see how the digital and tangible worlds can be intertwined to augment their ideas and activities.

## 3.  Goals

a.  To develop a special topics class in the art department that introduces students to programming and electronics with an open-source philosophy.  The course will be jointly taught by us (as part of Justin's regular teaching load, as an unpaid overload for Albert).  The hope is, for example, that students in the art department might bring some of these tools to bear in later undergraduate work.
b.  To attend at least one maker-style workshop in Seattle or Portland (where such events happen regularly).
c.  To bring in at least one speaker (Joseph Gray) to hold a one-day maker-style workshop on campus that is open to both students and faculty.
d.  To learn about gender skew in computer science education and some efforts to mitigate the skew.  We hope to implement some of what we learn in the special topics course that we offer.

## 4.  **Budget**

The majority of these expenses will be incurred during Summer 2014 and Fall 2014 (when we plan to offer the makerspace course described above, first goal).  If the associated maker space course runs again in Fall 2015, additional expenses to this budget might occur in Summer 2015 and Fall 2015.  As such, we ask that the following budget be in place starting June 1, 2014 and continuing to Jan 1 2016.

If the associate makerspace course becomes a regular course offering, continued funding (if necessary) will come from the art department budget which may be modified through normal channels to accommodate.

| Cost | Description |
|---|---|
| $500 | books |
| $2000 | Workshop/travel Albert Schueller |

| | |
|---|---|
| $2000 | Workshop/travel Justin Lincoln |
| $2000 | Supporting materials and equipment. |
| $8500 | **Total** |
| | |

5. **Project Assessment**

The assessment of the this proposed work will come in the form of a written report that addresses each of the goals described in the goals section.  The goals are straightforward with easily quantifiable outcomes.

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