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# Creating Ideas into Reality: Spaces and Programs that Open Up the Imagination

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# Creating Ideas into Reality:

# Spaces and Programs that Open Up the Imagination


## Abstract

Virtual reality, 3-D scanning, Arduino programming, oh my! Over the summer of 2016, the Lichtenberger Engineering Library at the University of Iowa designed a new a 575 square foot area called the Creative Space, a place for students, faculty, and staff to turn their ideas into reality and to get hands-on experience. The room enriches programs and resources already in place within the College, including the Engineering Electronics Shop, Engineering Machine Shop, and the Tool Library. The new resources allow users to explore the latest in virtual reality, 3-D scanning and modeling, Arduino programming, and wearable technology.

With the addition of the new space, sixty-one tools were added to the Tool Library increasing the amount available for check out up to 147. Between September 2012 and June 2016, 1,057 items were checked out and the most popular were the 25-foot tape measure, the digital caliper, pliers set, screwdriver set, and the multimeters. The new space, marketing, and word of mouth led to a significant increase in the usage of the Tool Library, with 902 items checked out during the fall 2016 semester alone. New items accounted for 489 of those items checked out. The tools in the Tool Library before the creation of the Creative Space accounted for 413 checkouts, which is above the average 137 items of previous semesters—around 3.2 times as much usage.

To kick off the new space and to assist in offsetting costs to the inventor, the Engineering Technology Center and Lichtenberger Engineering Library teamed up to create a scholarship/grant program called Creative Kick-Start. Ten groups/individuals were each awarded $500 to be used in either of our Shops on materials, labor, and tools needed to make his/her idea a reality.

This Creative Space and our Kick-Start program stimulate students to imagine, tinker, design, and—ultimately—create new and innovative projects.


## Background

This whole project began in 2012 with a single email from a professor asking if the Library would be open to checking out tools. The professor had tools to loan to students but no system for tracking the items. The Library was eager to add this new service and set up procedures and a loan policy. (Full policy and procedures can be found at http://www.lib.uiowa.edu/eng/tool-library/.)

The Tool Library started out with thirty-eight items available for checkout and items have been added ever since. News of the new Tool Library spread by word of mouth, triggering several different groups to donate tools.

At the beginning of 2016, it became apparent there was a need for items more geared toward creating and hands-on learning with a strong emphasis on technology. It also became evident that an outdated classroom and an adjoining storage room could be converted into a more usable space.

The College of Engineering already had the Electronic Shop and the Machine Shop in the building, providing 3-D printing and other prototyping services, and including a method for collecting payments and staffing for continuous maintenance. Essentially, all the College of Engineering was missing a place to design and develop these ideas before sending them to production. The idea of a place to create ideas and gain hands-on training from scratch is the origin of the Creative Space.

During the spring of 2016, the head librarian visited several regional university makerspaces to get a feel for what others in the field were undertaking. Three general themes developed from these visits and subsequent discussions:

1. prototyping (including 3-D scanning and printing)
2. virtual reality
3. computer programming/circuit building

In the summer of 2016, the Lichtenberger Engineering Library took a small computer classroom and a storage room and turned them into a 575-square foot makerspace called the Creative Space. The library's newly renovated room includes tinkering stations with access to different technologies and tools and areas for collaborative work, featuring whiteboards and quad monitors. This room is a place for students, faculty, and staff to turn their ideas into reality and to get hands-on experience.

In addition, the Tool Library, located inside the engineering library, was enhanced. Now, not only basic hand- and measuring tools can be checked out, but also more technical items such as 360 cameras, 3-D scanners, Arduino kits, light meters, and thermal cameras, and more. These new resources allow the user to explore the latest in virtual reality, 3-D scanning and modeling, Arduino programming, and wearable technology.

## Designing the Space

*The Engineer of 2020* recognized that creating, inventing, and innovating are essential skills for engineers (National Research Council, 2004). The need for spaces to help foster these skills has led to makerspaces becoming more and more popular throughout university libraries. These spaces provide opportunities for students, faculty, and staff to gain hands-on learning, thus sparking their imaginations and allowing them to be innovative and think outside the box. The library is an ideal setting for these spaces because it allows users from varied disciplines to work together and learn from each other.

While designing the Creative Space within the Lichtenberger Engineering Library, a major emphasis was to ensure the room had a welcoming and comfortable environment. No large equipment intimidating to students is visible when first entering the space (Sparrow, 2016).

Another major consideration was to ensure ample amounts of versatile seating and tables. The flexible space supports innovation and creativity in relation to two types of learning—exploitation and exploration—and five types of behaviors (Bieraugel & Stern, 2017, p. 36):

1. observing
2. questioning
3. experimenting
4. networking
5. reflection.

The configuration generates an adaptable, open, collaborative space to encourage creativity with glass whiteboards, counter height movable tables, and large computer monitors with multiple laptop connections. Computers along the back wall include numerous software packages needed for creating and designing in a digital environment, but do not dominate the room. The equipment is stored out of the way, but can be checked out as needed, all helping to create a welcoming atmosphere, encouraging users to work through all steps of the creating and innovating process.

**Overview of Creative Space and Tool Library**

The Creative Space and the Tool Library now feature 147 tools, available for student, faculty, and staff checkout, and a 575-square foot room complete with the tools and technology necessary to create projects related to prototyping, virtual reality, and programming/circuit building.

The new space focuses on versatility without assigning what can be done to only one place in the room. This allows for users to manipulate the space as they need. Five whiteboards and two easily movable open tables are features of the room allowing for exploring, experimenting, and creating projects. Two collaboration tables with 4K quad monitors are perfect for group work, as are computers available for 3-D scanning, designing, and modeling. One dedicated computer for use with virtual reality systems requires an equivalent GTX 970/AMD R9 290 video card or greater. A photo after deconstruction of the wall between the classroom and the storage room can be seen in Figure 1, and a full floor plan can be seen in Figure 2.

Figure 1: The computer classroom right after the wall was removed.

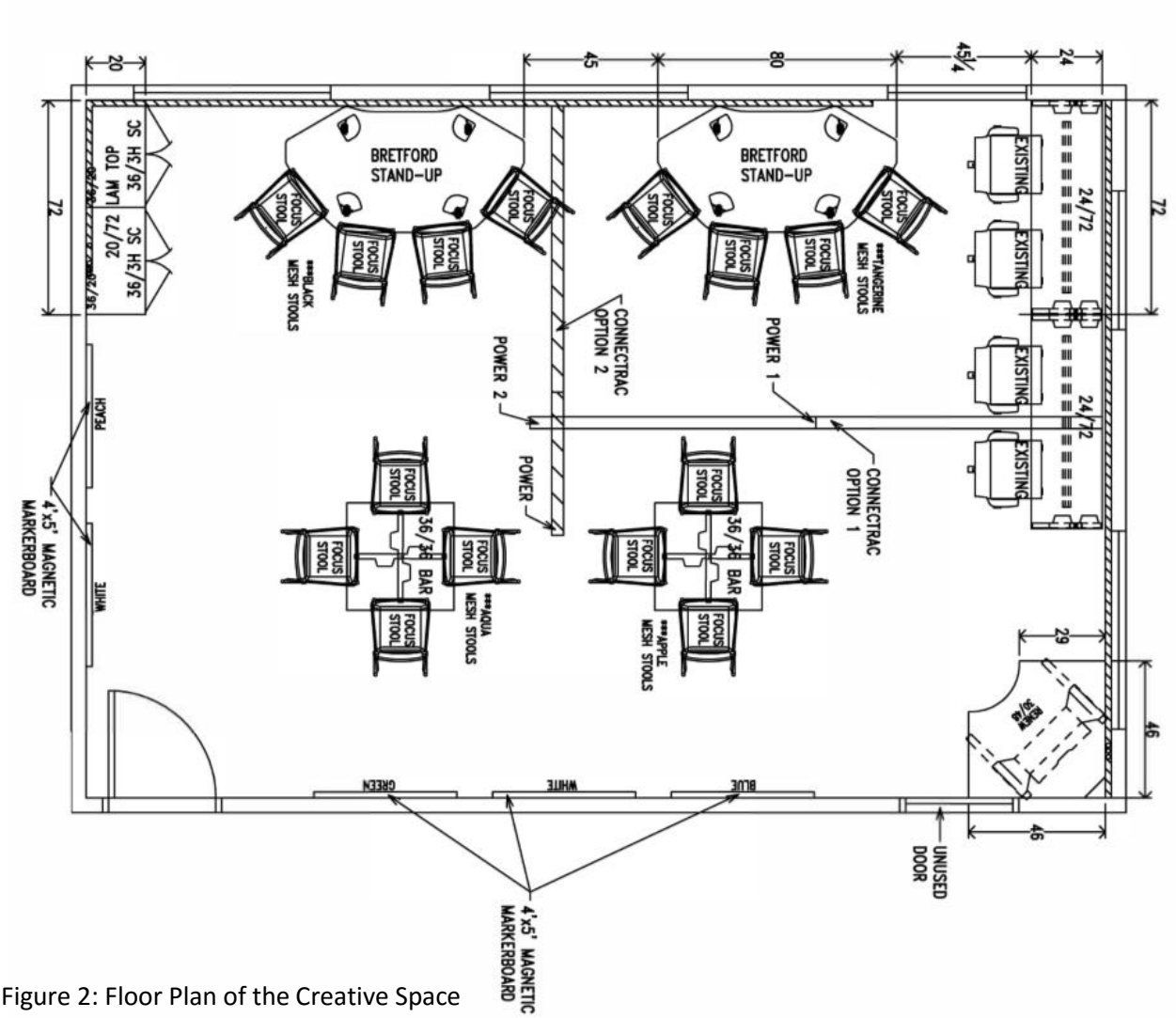


Figure 2: Floor Plan of the Creative Space

With the new space, sixty-one items were added to enrich the Tool Library. Twenty-nine were cables, adapters and chargers.

The other thirty-two are all related to the three central themes of the creative space:

Prototyping

- four types of 3-D scanners
- drawing tablets
- various measuring and hand tools needed to build items from scratch

Virtual Reality

- Oculus Rift headset
- Movio BT-300 augmented reality headset
- leap motion controllers
- 360 degree cameras

Programming/Circuit Building

- a series of creative boxes, created or purchased by the library, providing tools for exploring and testing circuit building.
- Raspberry Pi
- Arduino Robot
- Makey Makey cables
- wearable technology
- solderless circuit board with Arduino board kits

All but the virtual reality sets may be checked out for seven days to use within the Creative Space, in class, or to take home.

**FULL LIST OF AVAILABLE TOOLS**

*Technology Tools:* Oculus Rift (2 hrs.), Movio BT-300 (2 hrs.), Leap Motion controllers, RICOH Theta camera, 360Fly 4K camera, Canon Powershot camera, Sense 3-D scanner, Structor sensor for iPad scanner, Xbox Kinect, acoustic microphone, eyeball webcam, Wacom drawing tablets, adapters, chargers

- *Hand Tools*: adjustable wrench, claw hammer, computer toolkit, diagonal pliers, hex key sets (metric & SAE), mini plier set, mini screwdriver set, mini torx screwdriver set, pliers sets, screwdriver set, security bits collector set, socket set, video game screwdriver set, wire cutter/stripper, wrench set
- *Measuring Tools*: caliper, digital scale, environmental meter, infrared thermometer, thermal imaging camera, laser distance measurer, level & magnetic angle locator, light meter, micrometer, multimeter (volt meter), pocket grain weight scale, power monitor, sound level meter, tachometer, tape measure, triple beam balance, tubular spring scales, wireless temperature probe
- *Labquest Equipment*: LabQuest data collector, 3-axis accelerometer, $CO_2$ sensor, dual-range force sensor, EKG sensor, electrode amplifier, force plate, go! motion, goniometer, instrumentation amplifier, low-g accelerometer, magnetic field sensor, microphone, PH sensor, power amplifier, rotary motion sensor, sound level meter, stainless steel temperature probe, surface temperature probe, thermocouple, watts up pro, wireless dynamics senor system
- *Creative Boxes*: MaKey MaKey kit, Raspberry Pi 3 with Vernier Interface Shield, littleBits, Inventor's kit, wearable tech, RedBot Inventor's kit

All these tools and other items are still yet a fraction of the resources available to promote innovation and creation within the Creative Space. The whiteboards, computers, and arrangement within the space allow students the opportunity to brainstorm and explore their ideas. The space and the Tool Library together allow for further exploration of ideas and the opportunity to observe those innovations in action. Because the room is open to all, student interaction, networking, and sharing of concepts and designs are facilitated.

Figure 3-5: Photos of students using the Leap Motion Software, Oculus Rift, whiteboards, and collaboration tables.

**Usage Statistics**

The addition of the Creative Space and the acquisition of new items in the Tool Library triggered a significant rise in usage statistics. A full table showing the usage statistics for September 2012 to December 2016 is available in Appendix A. Items italicized represent the sixty-one new items added during the summer of 2016. The items bolded represent items that are not available for seven-day loan; these include chargers and adapters, which are available for one day, and the Oculus Rift, which is available for two hours.

Of the 1,057 items checked out between September 2012 and June 2016, the most popular were the 25-foot tape measure, the digital caliper, pliers set, screwdriver set, and the multimeters. (See Table 1). An average of 137 items per semester were checked out during these eight semesters.

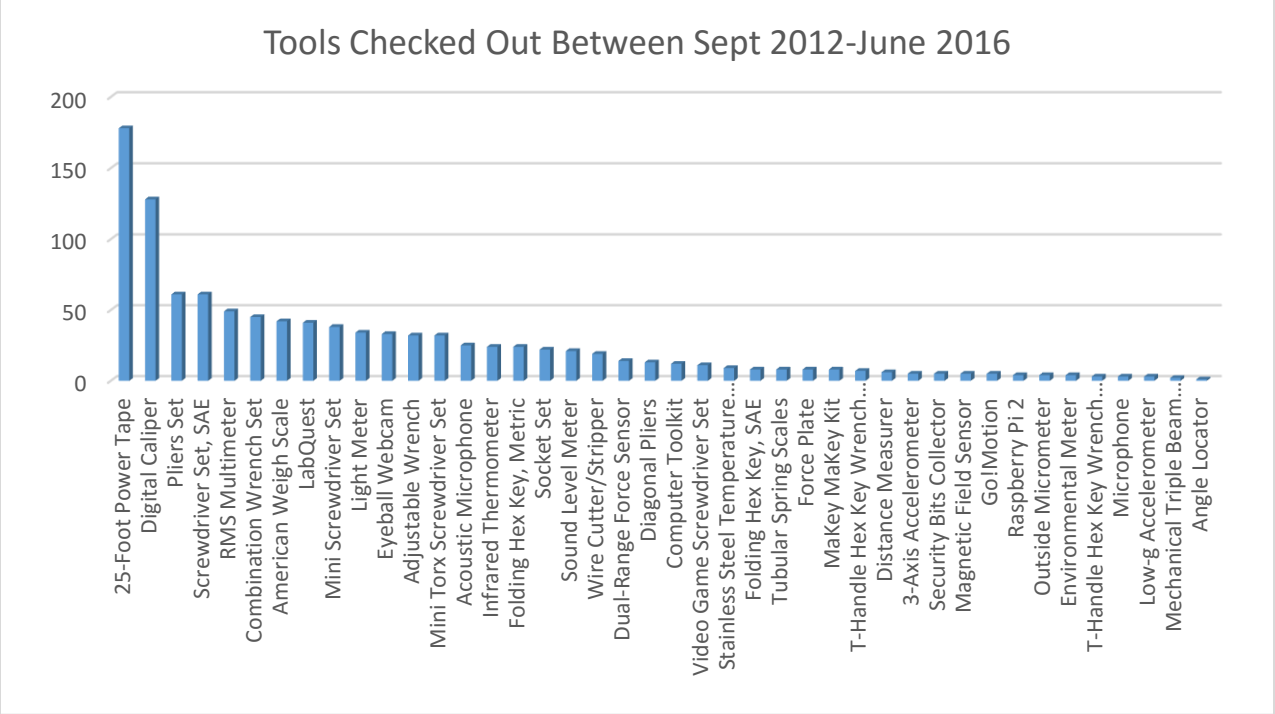


Table 1: Tools Checked Out September 2012-June 2016

On September 8, 2016, the Creative Space opened and twenty-six items were added to the Tool Library. The new space, marketing, and word of mouth led to a significant increase in the usage of the Tool Library, with 902 items checked out during the fall 2016 semester alone. New items accounted for 489 of those items checked out.

This means the tools in the Tool Library before the creation of the Creative Space accounted for 413 checkouts, which is above the average 137 items of previous semesters—around 3.2 times as much usage. Since the grand opening of the space was three weeks after the semester began, many of the newer items were not available at that time. Those items were, therefore, only available for roughly thirteen weeks. The Oculus Rift, with its two-hour checkout and only available after September 8, was checked out forty times over the course of the seventy-eight days the library was open during the semester. Table 2 features a hierarchical chart showing usage of the new items added for the fall semester (excluding cables and adapters).

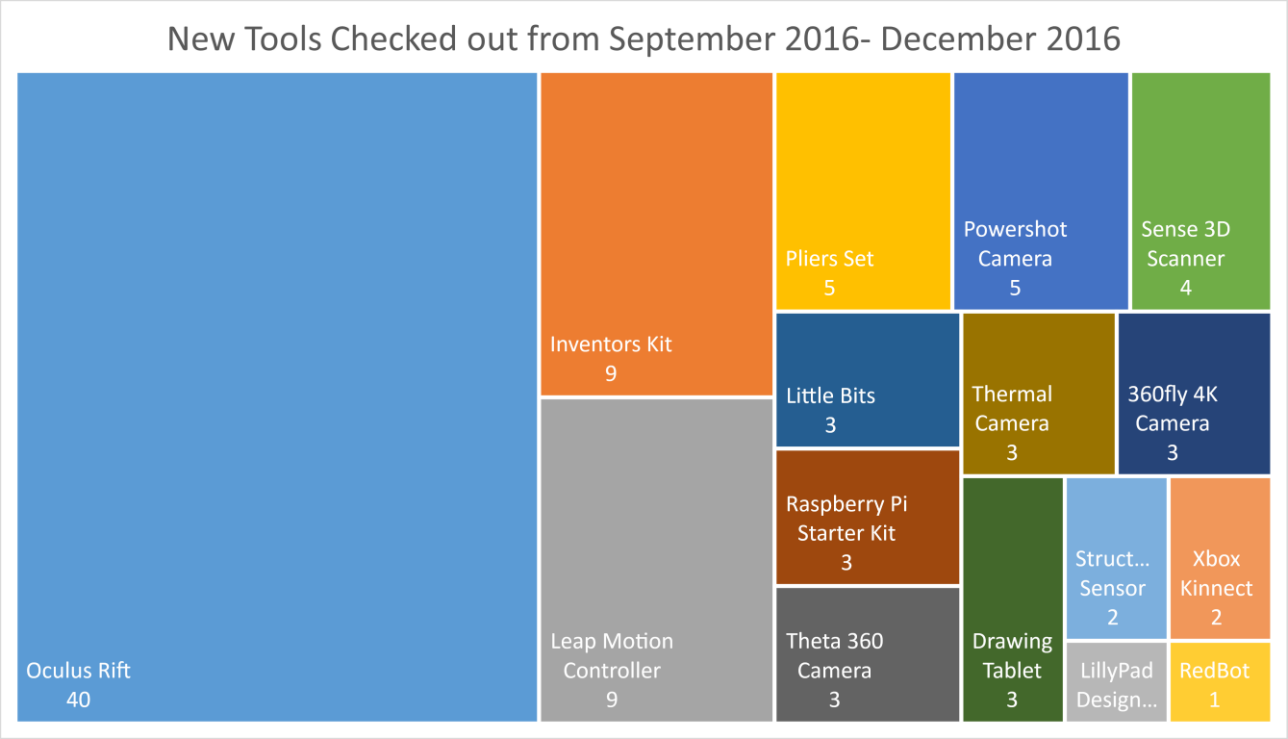


Table 2: Hierarchy Chart of Tools Checked Out September 2016 - December 2016

## Class Integration & Student Feedback

The integration of the Creative Space with classroom projects has been slowly developing over time. Most of the first semester was devoted to giving tours of the space to faculty and speaking about opportunities for collaboration. Several engineering classes, as well as a digital art class and a library science class, also brought their students in for a tour.

Individual students have found the room very beneficial for their projects. The following from Jared Becker, senior in Mechanical Engineering, helps to highlight the effectiveness of the space:

> *I want to thank you for supporting myself and my peers in our continued pursuit of knowledge and academic excellence here, at the University of Iowa. The Creative Space provides a highly engaging and collaborative atmosphere unlike anywhere else in the Engineering College. Myself and my classmates find that the room's advanced technological access provides a highly stimulating atmosphere necessary for creative problem solving. Also, this space provides a very natural feel: the sleek design, abundant windows and natural lighting provides a sense of comfort and mental clarity when processing complicated problem sets or feeling overwhelmed by course work; we are very grateful for its existence.*
>
> *Thank you again for helping to enrich my academic experience and I hope you can continue to support my desire to make a change in the world.*

**Outreach: Kick-Start Project**

The Creative Space is part of an entire network within the College of Engineering providing services and resources for students to create and build. The Engineering Technology Center, which includes the Electronic Shop and the Machine Shop, is part of this network, which offers students, faculty, and staff a way to complete their projects, seeing them through the final steps of building and 3-D printing. Due to the need for cost recovery of consumable items, there may be some nominal costs for students using the services available through the Electronic Shop or Machine Shop.

Understanding these costs might be a barrier for some students to complete their projects, Engineering Technology Center put forward $5,000 to create a grant program for students.

Using the Adobe Kickbox (Adobe Systems, 2017) and the Elon University Kickbox programs (Reis, 2016) as models, our Creative Kick-Start program was developed for engineering students (undergraduate and graduate) to request funding to help pay for prototyping/finishing their projects through the services provided by the Creative Space, Engineering Electronics Shop, and Machine Shop. Ten awards of $500 each were given out. These awards must be used in the Electronics and/or Machine shops.

The process for this program includes

- thinking of an idea for a project which can be completed in roughly three months; .
- identifing a faculty or staff sponsor to offer support and advice;
- completing an online application explaining the idea and why it is worth pursuing (applications open until December 9, 2016);
- compulsory attendance at ONE of two in-person workshops offered on Tuesday, January 24, 2017, from 12 p.m. or Thursday, January 26, 2017, from 5-6 p.m. (inventors receive a fund code to access their $500 at the workshop);
- providing a progress report midway through the semester documenting a meeting between sponsor and inventor (due by March 10, 2017); and
- presenting their project as a poster during the College of Engineering Research Open House in April 2017.

We did not have any specific projects in mind. They could solve a problem in the world, on campus, or in the student's room; they could be a prototype or a finished product.

During the workshop in January, each inventor will receive a RedBox (Figure 3) that includes

- Kick-Start Card
    - This card has the ID number for accessing the $500 in the Electronics Shop or Machine Shop.
- Quick Reference Cards
    - A list of people and spaces on campus to help with the projects
- Hawk Dollars Gift Card

    - This is a $25 gift card to any dining or coffee shop on campus. It was (strongly!) suggested this card be used to take faculty sponsors out for coffee to discuss their ideas!
- Spiral Notebook
    - Brainstorming, planning the next steps, working through a problem using this spiral notebook to keep it all together
- Post-it® Notes
    - Stuck? Not sure what to do next? Need a reminder? Use these to work out a problem or set a reminder.
- Bad Ideas Notebook
    - Most great ideas begin life looking like bad ideas. That's why the RedBox contains a notebook for Bad Ideas but none for Good Ideas. We're less judgmental if we label our raw ideas "Bad" in advance. Keep that notebook handy.
- Progress Report
    - Use these to help plan the project. May also be used for talking points when meeting with their sponsor. One report due to the Engineering Librarian by March 10, 2017.
- Expenses Spreadsheet
    - This is used to keep track of expenses for the project. View the electronic version at https://goo.gl/eoYfvB.


Figure 6: The 10 RedBoxes to be handed out to Kick-Start award winners

The Inventions Manager from the Research Foundation, the Faculty Lead for the Founders Club, a part of the University Entrepreneurial Center, and representatives from the Machine Shop and the Electronic Shop, were in attendance to provide additional information to the students about patenting and the possibilities of creating businesses from their projects.

The students have the spring semester to complete their projects. They must send in one mid-semester progress report due March 10, 2017, to the Engineering Librarian.

All the award winners are asked if they are planning to patent their idea/project. This question requires us to alter what information will be sent out for marketing. We need to make sure the descriptions sent out to the general public were vague enough not to violate the public disclosure agreement before beginning the patent process.

In April, each student will present his/her poster at the College of Engineering Research Open House. During this event, participants will showcase their projects and discuss how they have evolved throughout the semester. The students have been told from the start that it is okay if the projects fail since failure is merely a stepping-stone along the innovation process. Even if the project "fails," the presentation is still mandatory. In addition to presenting at the Open House, the students may also volunteer to present their projects during a campus-wide Innovation Expo at the end of April.

The Creative Kick-Starts project provides a great opportunity for students to work through the entire process—from developing a project, writing a proposal, working under a time deadline, and presenting their work. Besides providing a unique opportunity for students, it provides the added benefit of marketing the Creative Space, Electronic Shop, and Machine Shop to those within the college and the campus as a whole.

## Conclusion

"Creativity, invention, and innovation are values championed as central pillars of engineering education" (Forest et al., 2014, p. 1). The Creative Space works to encompass all aspects of creation and innovation learning and behaviors: exploitation, exploration, observation, questioning, experimenting, networking, and reflection. The collaboration between the Engineering Technology Center and the Creative Space enhances services offered by both entities to ensure that students can fully explore all aspects of innovation by providing opportunities to tinker, explore, brainstorm, and create.

## Acknowledgments

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Thank you to all those at the University of Minnesota (LATIS [Liberal Arts Technologies and Innovation Services], Medical Device Center, Walter Engineering Library, and DigiFabLab [College of Design]), University of Wisconsin – Madison (Wendt Commons [Engineering Library], Garage Physics, and Discovery Building), and University of Illinois – Urbana-Champaign (Undergraduate Library and Granger Engineering Library) for meeting to share your experiences and ideas.

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Appendix A: Total Tools Checkout From 2012-2016

| Item Description | Units | Sept 2012-Dec 2015 | Jan 2016 - June 2016 | July 2016 - Dec 2016 | Total |
|---|---|---|---|---|---|
| 25-Foot Power Tape | 3 | 102 | 76 | 61 | 239 |
| Digital Caliper | 3 | 76 | 52 | 52 | 180 |
| ***Lightning Charger*** | ***2*** | ***0*** | ***0*** | ***94*** | ***94*** |
| Screwdriver Set, SAE | 1 | 33 | 24 | 26 | 83 |
| RMS Multimeter | 2 | 33 | 28 | 14 | 75 |
| LabQuest | 3 | 25 | 16 | 22 | 63 |
| Pliers Set | 1 | 37 | 7 | 12 | 56 |
| Mini Screwdriver Set | 1 | 31 | 16 | 8 | 55 |
| Eyeball Webcam | 2 | 24 | 16 | 12 | 52 |
| Combination Wrench Set | 2 | 29 | 9 | 11 | 49 |
| Socket Set | 1 | 14 | 21 | 14 | 49 |
| ***Ruler Set*** | ***3*** | ***0*** | ***0*** | ***48*** | ***48*** |
| ***Oculus Rift*** | ***1*** | ***0*** | ***0*** | ***40*** | ***40*** |
| Acoustic Microphone | 2 | 16 | 15 | 7 | 38 |
| ***HDMI to VGA*** | ***4*** | ***0*** | ***0*** | ***37*** | ***37*** |
| ***MicroUSB Charger*** | ***2*** | ***0*** | ***0*** | ***37*** | ***37*** |
| ***MagSaf to MagSafe2 Converter*** | ***1*** | ***0*** | ***0*** | ***36*** | ***36*** |
| American Weigh Scale | 1 | 21 | 9 | 4 | 34 |
| Folding Hex Key, SAE | 2 | 8 | 16 | 8 | 32 |
| Video Game Screwdriver Set | 1 | 7 | 17 | 8 | 32 |
| Diagonal Pliers | 2 | 7 | 6 | 17 | 30 |
| Mini Torx Screwdriver Set | 2 | 15 | 8 | 6 | 29 |
| Computer Toolkit | 2 | 8 | 11 | 9 | 28 |
| Dual-Range Force Sensor | 2 | 4 | 14 | 10 | 28 |
| ***60W MagSafe Charger*** | ***1*** | ***0*** | ***0*** | ***28*** | ***28*** |
| Adjustable Wrench | 1 | 16 | 4 | 4 | 24 |
| Light Meter | 1 | 19 | 0 | 5 | 24 |
| Infrared Thermometer | 1 | 13 | 4 | 5 | 22 |
| Folding Hex Key, Metric | 2 | 10 | 6 | 5 | 21 |
| ***45W MagSafe Charger*** | ***1*** | ***0*** | ***0*** | ***21*** | ***21*** |
| MaKey MaKey Kit | 1 | 2 | 14 | 4 | 20 |
| ***Minidisplay Port to VGA*** | ***4*** | ***0*** | ***0*** | ***20*** | ***20*** |
| Sound Level Meter | 1 | 15 | 0 | 3 | 18 |
| ***Laptop Charger*** | ***2*** | ***0*** | ***0*** | ***18*** | ***18*** |
| ***Calculator*** | ***2*** | ***0*** | ***0*** | ***17*** | ***17*** |
| ***85W MagSafe Charger*** | ***1*** | ***0*** | ***0*** | ***15*** | ***15*** |
| EKG Sensor | 1 | 0 | 10 | 4 | 14 |
| Tubular Spring Scales | 2 | 4 | 4 | 6 | 14 |
| Wire Cutter/Stripper | 4 | 5 | 2 | 7 | 14 |
| Distance Measurer | 1 | 4 | 4 | 5 | 13 |
| 3-Axis Accelerometer | 1 | 2 | 6 | 4 | 12 |
| Security Bits Collector | 1 | 2 | 6 | 3 | 11 |
| Force Plate | 1 | 4 | 3 | 4 | 11 |
| 6-piece Mini Plier Set | 1 | 0 | 3 | 8 | 11 |
| ***Minidisplay Port to HDMI*** | ***2*** | ***0*** | ***0*** | ***10*** | ***10*** |
| *Inventors Kit* | 3 | *0* | 0 | 9 | 9 |
| *Leap Motion Controller* | *7* | *0* | 0 | *9* | 9 |
| Digital Scale | 1 | 0 | 2 | 6 | 8 |

| | | | | | |
|---|---|---|---|---|---|
| Rotary Motion Sensor | 1 | 0 | 5 | 2 | 7 |
| Raspberry Pi 2 | 2 | 2 | 0 | 5 | 7 |
| 2-piece plier set | 1 | 0 | 2 | 5 | 7 |
| T-Handle Hex Key Wrench Set, SAE | 1 | 2 | 0 | 4 | 6 |
| Tachometer | 1 | 0 | 2 | 3 | 5 |
| *Pliers Set, 2 piece* | *1* | *0* | *0* | *5* | *5* |
| *Powershot Camera* | *1* | *0* | *0* | *5* | *5* |
| Instrumentation Amplifier | 1 | 0 | 3 | 1 | 4 |
| CO2 Gas Sensor | 1 | 0 | 3 | 1 | 4 |
| T-Handle Hex Key Wrench Set, Met | 1 | 1 | 2 | 1 | 4 |
| Watts Up Pro | 1 | 0 | 2 | 2 | 4 |
| Outside Micrometer | 1 | 2 | 0 | 2 | 4 |
| *Sense 3-D3-D Scanner* | *1* | *0* | *0* | *4* | *4* |
| Stainless Steel Temperature Probe | 1 | 3 | 0 | 0 | 3 |
| Vernier Interface Shield | 1 | 0 | 2 | 1 | 3 |
| Wireless Temperature Probe | 1 | 0 | 1 | 2 | 3 |
| Goniometer | 1 | 0 | 0 | 3 | 3 |
| Wireless Dynamics Sensor System | 1 | 0 | 0 | 3 | 3 |
| Claw Hammer | 1 | 0 | 0 | 3 | 3 |
| *Little Bits* | *1* | *0* | *0* | *3* | *3* |
| *Raspberry Pi Starter Kit* | *1* | *0* | *0* | *3* | *3* |
| *Theta 360 Camera* | *1* | *0* | *0* | *3* | *3* |
| *Thermal Camera* | *1* | *0* | *0* | *3* | *3* |
| *360fly 4K Camera* | *1* | *0* | *0* | *3* | *3* |
| *Drawing Tablet* | *2* | *0* | *0* | *3* | *3* |
| ***Lightning to VGA*** | ***1*** | ***0*** | ***0*** | ***3*** | ***3*** |
| ***HDMI To MINIHDMI*** | ***2*** | ***0*** | ***0*** | ***3*** | ***3*** |
| ***30 Pin Charger*** | ***1*** | ***0*** | ***0*** | ***3*** | ***3*** |
| Environmental Meter | 1 | 2 | 0 | 0 | 2 |
| Magnetic Field Sensor | 1 | 2 | 0 | 0 | 2 |
| Go!Motion | 1 | 2 | 0 | 0 | 2 |
| *Structure Sensor* | *1* | *0* | 0 | *2* | 2 |
| *Xbox Kinnect* | *2* | *0* | *0* | *2* | *2* |
| ***USB-C Charger*** | **2** | **0** | **0** | **2** | **2** |
| Microphone | 1 | 1 | 0 | 0 | 1 |
| Low-g Accelerometer | 1 | 1 | 0 | 0 | 1 |
| Mechanical Triple Beam Balance | 1 | 1 | 0 | 0 | 1 |
| Angle Locator | 1 | 1 | 0 | 0 | 1 |
| Power Amplifier | 1 | 0 | 0 | 1 | 1 |
| *LillyPad Design Kit* | *1* | *0* | *0* | *1* | *1* |
| *RedBot* | *1* | *0* | *0* | *1* | *1* |
| ***USB Extender*** | ***2*** | ***0*** | ***0*** | ***1*** | ***1*** |
| Power Monitor | 1 | 0 | 0 | 0 | 0 |
| Electrode Amplifier | 1 | 0 | 0 | 0 | 0 |
| pH Sensor | 1 | 0 | 0 | 0 | 0 |
| Surface Temperature Sensor | 1 | 0 | 0 | 0 | 0 |
| Sound Level Meter | 1 | 0 | 0 | 0 | 0 |
| Thermocouple | 1 | 0 | 0 | 0 | 0 |
| ***30 Pin to VGA*** | ***1*** | ***0*** | ***0*** | ***0*** | ***0*** |
| ***Checkouts Per Semester*** | **145** | **606** | **451** | **902** | |
| | | | *Total Checkouts Since 2012* | | ***1959*** |