

Academic Quality and Student Success Committee Agenda

	<u>Page</u>
1. Call to Order/Roll/Declaration of a Quorum (8:00am) <i>Chair Jeremy Brown</i>	
2. Consent Agenda <i>Chair Jeremy Brown</i>	
2.1 Approve Minutes of the May 17, 2018 Meeting	1
3. Action Items	
3.1 Recommendation to the full Board to Approve the New Program Approval Process (15 min) <i>Provost Gary Kuleck</i>	4
4. Discussion Items (8:20am)	
4.1 Provost's Report (30 min) <i>Provost Gary Kuleck</i>	7
4.2 Summer Grant Projects and Sabbaticals (8:50am) (20 min) <i>Provost Gary Kuleck</i>	14
4.3 General Education Reform Update (9:10am) (10 min) <i>Professor Dan Peterson and Registrar Wendy Ivie</i>	101
BREAK 9:20am - 9:30am	
4.4 Introduction of Cybersecurity Degree (9:30am) (25 min) <i>Assistant Professor Tracey Coon and Associate Professor Sharon Beaudry</i>	118
4.5 Employment Searches Report (9:55am) (15 min) <i>Acting Director Sandi Hanan</i>	125
4.6 Career Services Presentation (10:10am) (30 min) <i>Director Jennifer Kass</i>	129
5. Other Business/New Business (10:40am) (5 min) <i>Chair Jeremy Brown</i>	
6. Adjournment (10:45am)	



**Meeting of the
Oregon Tech Board of Trustees
Academic Quality and Student Success Committee
Center for Health Professions, Room 100, Klamath Falls Campus
May 17, 2018
8:00am–10:30am**

**Academic Quality and Student Success Committee
DRAFT MINUTES**

Trustees Present:

Jeremy Brown, Chair
Kathleen Hill
Jill Mason

Kelley Minty Morris
Celia Núñez
Liam Perry

Dan Peterson

University Staff and Faculty Present:

Erin Foley, VP of Student Services/Dean of Student Affairs
Rick Hoylman, Medical Imaging Technology Professor
Leah Jolly, Medical Imaging Technology Instructor
Bobbie Kowash, Medical Imaging Technology Assistant Professor
Gary Kuleck, Provost/Dean of Academic Affairs
Adria Paschal, Senior Executive Assistant to the President
Shirlee Templeton, Natural Science Instructor

1. Call to Order/Roll/Declaration of a Quorum

Chair Brown called the meeting to order at 8:04am. The President's Senior Executive Assistant called roll and a quorum was declared.

2. Consent Agenda

2.1 Approve Minutes of the March 22, 2018 Meeting

Trustee Mason moved to approve the minutes of the March 22, 2018 meeting.

Trustee Peterson seconded the motion. With all Trustees present voting aye, the motion passed unanimously.

3. Action Items - none

4. Discussion Items

4.1 Provost's Report

Provost Kuleck identified projects underway including establishing clearer guidelines on shared governance, general education reform and the new platform *Thought Exchange* to encourage discussion, and the summer creativity grant program to encourage creative works by faculty. Provost Kuleck will share the shared governance report and the general education reform survey results with the Trustees. Trustee Minty Morris arrived at 8:09am.

4.2 Sabbatical Leaves

Provost Kuleck explained sabbatical leaves are for two to three terms and allow time for faculty to engage in professional development, which assists in their career and can raise the image and awareness of the institution. Seven sabbatical requests are awaiting the president's signature.

4.3 New Program Development and Review Process Update

Provost Kuleck presented a PowerPoint outlining the graduate and undergraduate new program approval process. He believes the new program development process can be modified to become a review process for existing programs to determine which might be phased out, modified, or continue without any changes. He outlined four key traits desired of a new program: unique to Oregon Tech branding, market-driven, revenue generating, and reputation enhancing. **Chair Brown** suggested, in addition to programs that define Oregon Tech, that a co-alignment of programs be considered. **Provost Kuleck** anticipates the following new programs will be brought before the Board soon: manufacturing engineering, robotics, and data science. He will bring the post-review process to the committee in fall 2018 or summer 2019 for discussion. Discussion regarding the need for additional feedback from the committee on the program approval process and that modifications to the process can happen as we move through the process. **Chair Brown** explained that the committee wants to ensure all new programs have gone through an extremely thorough review process prior to being presented to the committee and that there is no rush to approve the program.

4.4 Report out on Employment Searches

Provost Kuleck announced he is in the final negotiations with an ETM Dean candidate and anticipates hiring an Associate Provost for Research and Academic Affairs, to be located at the Portland-Metro campus, next week. He mentioned the University Librarian search and 18 faculty searches. **Chair Brown** requested a report on how we attract a diverse applicant pool and how that carries through to the hires.

4.5 Medical Imaging Externships and Industry partnerships

Professor Hoylman gave a PowerPoint presentation covering the five medical imaging programs, competitive differentiations, student make-up, the impact the programs have on the university revenue, student success, development of industry partnerships, equipment needs, and the request that administration and the board consider alternative marketing and tuition strategies to increase the number of out of state students.

5. Other Business/New Business

Items for future agendas include: summary presentation on summer creative grant projects, new program review and approval process and existing program review process, report on *Thought Exchange* survey on General Education reform, shared governance report, and a report on diversity in hiring.

6. Adjournment

Trustee Minty Morris moved to adjourn the meeting at 9:46am. Trustee Núñez seconded the motion. With all trustees present voting aye, the motion passed unanimously.

The trustees joined Professor Hoylman for a tour of the Medical Imaging Labs until 10:30am.

Respectfully submitted,

A handwritten signature in blue ink, appearing to be 'S. Fox', written in a cursive style.

Sandra Fox
Board Secretary

ACTION

Agenda Item 3.1

Recommendation to the Full Board to Approve the New Program Approval Process

Background

The previous process by which new programs were proposed, vetted, and approved was outdated. The Curriculum Planning Commission and Grad Council worked on an amendment to the process to address thorough market, enrollment, and financial analyses. This new proposal process meets the HECC's requirements.

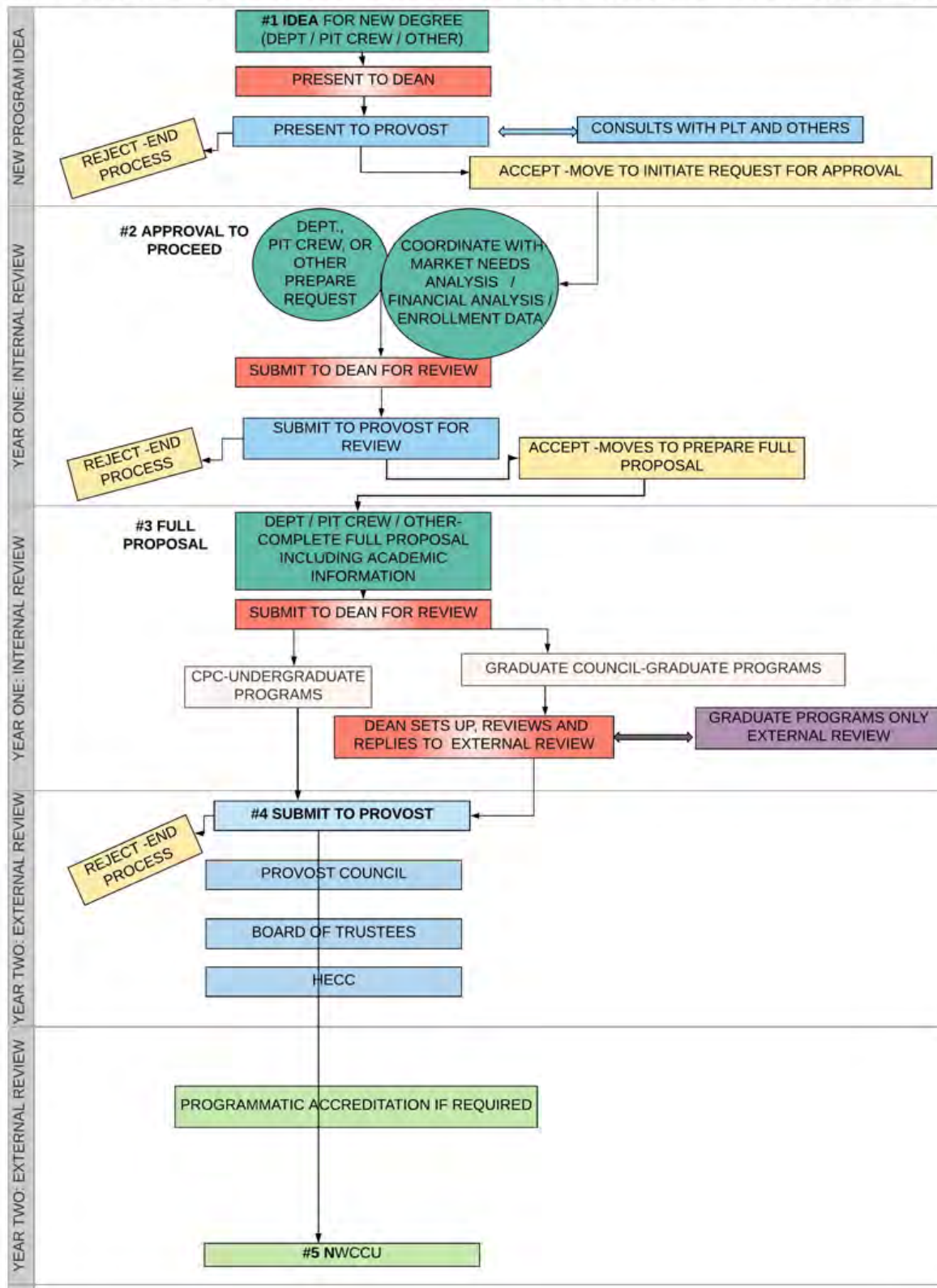
Recommendation

Staff recommends the Committee make a recommendation to the full board to approve the new program approval process as presented.

Attachments

- New Program Approval Process Flow Chart
- New Program Approval Process Spreadsheet

GRADUATE AND UNDERGRADUATE NEW PROGRAM APPROVAL PROCESS FLOW CHART



NEW PROGRAM APPROVAL PROCESS		New Program	New Location	Substantive Revision	Lesser Revision	New Minor, Certificate, Option or Specialization over 45cr.	New Minor, Certificate, Option or Specialization under 45cr.	New Emphasis	Discontin. of Program	Discontin. of Minor, Certificate, Option or Specialization	Name Change of Program, Minor, Certificate, Option or Specialization	Course Change, New Course
Idea												
Approval to Proceed	Chair	as needed	as needed	as needed	N/A	as needed	as needed	N/A	N/A	N/A	N/A	N/A
	Budget Office				N/A			N/A	N/A	N/A	N/A	N/A
	Dean	1-Mar of prelim. year	1-Mar of prelim. year	1-Mar of prelim. year	N/A	1-Mar of prelim. year	1-Oct of year 1	N/A	N/A	N/A	N/A	N/A
	Provost	1-Apr of prelim. year	1-Apr of prelim. year	1-Apr of prelim. year	N/A	1-Apr of prelim. year	15-Oct of year 1	N/A	N/A	N/A	N/A	N/A
	back to department	15-Jun of prelim. year	15-Jun of prelim. year	15-Jun of prelim. year	N/A	15-Jun of prelim. year	1-Nov of year 1	N/A	N/A	N/A	N/A	N/A
Full Proposal	Chair	as needed	as needed	as needed		as needed	as needed	as needed	as needed	as needed	as needed	as needed
	Dean	1-Dec of year 1	1-Dec of year 1	1-Dec of year 1	1-Jan of year 1	1-Oct of year 1	1-Dec of year 1	N/A	1-Dec of year 1	1-Feb of year 1	1-Feb of year 1	1-Feb of year 1
	CPC	1-Jan of year 1	1-Jan of year 1	1-Jan of year 1	1-Feb of year 1	15-Oct of year 1	1-Jan of year 1	N/A	1-Jan of year 1	15-Feb of year 1	15-Feb of year 1	15-Feb of year 1
	Provost	1-Apr of year 1	1-Apr of year 1	1-Apr of year 1	1-Apr of year 1	1-Dec of year 1	15-Feb of year 1	N/A	1-Feb of year 1	1-Apr of year 1	1-Apr of year 1	1-Apr of year 1
	Board of Trustees	1-May of year 1	1-May of year 1	1-May of year 1	N/A	1-Jan of year 1	1-Mar of year 1	N/A	1-Mar of year 1	N/A	N/A	N/A
	Provost Council	1-Aug of year 1	1-Aug of year 1	1-Aug of year 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	HECC	1-Oct of year 2	1-Oct of year 2	1-Oct of year 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NWCCU	1-Jan of year 2	1-Jan of year 2	1-Jan of year 2	N/A	1-Feb of year 1	N/A	N/A	N/A	N/A	N/A	N/A
	Registrar's office	15-Apr of year 2	15-Apr of year 2	15-Apr of year 2	15-Apr of year 1	15-Apr of year 1	15-Apr of year 1	15-Apr of year 1	15-Apr of year 1	15-Apr of year 1	15-Apr of year 1	15-Apr of year 1
Implementation		Fall of year 3	Fall of year 3	Fall of year 3	Fall of year 2	Fall of year 2	Fall of year 2	Fall of year 2	Fall of year 2	Fall of year 2	Fall of year 2	Fall of year 2

DISCUSSION

Agenda Item 4.1

Provost's Report

Background

Dr. Kuleck will provide a verbal summary of the following:

- DPT Program Update
- Dr. Skip Meyers' Shared Governance Report
- Proposed degree programs and status
- Accreditation updates

Recommendation

None. Item is informational only.

Attachments

- [Dr. Skip Meyer's Shared Governance Report](#)
- [HAS Accreditation Timeline](#)
- [ETM Accreditation Timeline](#)
- [NWCCU Accreditation Timeline](#)

Academic Shared Governance at Oregon Tech

Authored by Dr. Skip Meyers

Summary Observations and Recommendations to Provost Dr. Gary Kuleck

Introduction

Casagrande Consulting LLC (the Consultant) was engaged by Oregon Institute of Technology (the Client) to create and deliver at two sessions of the Provost's Forum a seminar presentation on shared governance, particularly as it is practiced effectively in the current challenging higher education ecosystem. Given the scheduling of the two sessions (the first on Tuesday, May 1, and the second on Thursday, May 3) there was ample time in the Consultant's schedule before the first presentation, between the two presentations, and after the second presentation for his interaction and conversations with key stakeholders about the state of shared governance at Oregon Tech. These key stakeholders included, in addition to the Provost, the President, the Vice President for Finance and Administration, the chief Human Resources officer, General Counsel, deans, department chairs, members of the Faculty Senate leadership, and the privilege of attending and observing a formal meeting of the Faculty Senate.

Effective and successful shared governance embraces the following institutional "cultural markers": **trust, collaboration, communication, transparency, inclusiveness, honesty, and integrity**. In conversations with key stakeholders, the Consultant sought to determine within the timeframe allowed the degree to which these cultural markers exist.

The following are summary observations and recommendations for the Provost's consideration.

Summary Observations

- OIT has an excellent reputation and enjoys the passionate support of its students. Its faculty, from those conversations with the Consultant, also profess a passion for their teaching and for the institution.
- The leadership recognizes the significant contributions the faculty has made to building this excellent reputation. Faculty demonstrate unwavering dedication to student success through engaged pedagogy, whether that takes place in the classroom, teaching laboratory, or through their involvement with students in creative activities that benefit both faculty and student professional development.

- OIT has enormous untapped potential and is poised on the cusp of a different and positive trajectory, with a new president whose vision is to capitalize on that potential and execute on the trajectory. This vision is actively supported by the institution's governing board.
- That vision represents a departure in many ways from the culture of the past, what has been done, and how it's been done. The change that departure will require in the institution is of concern to some key stakeholders who have been with the institution for a number of years.
- There appears to be a lack of clarity, understanding and acceptance between some members of Faculty Senate leadership and academic administration leadership in trying to establish the boundaries of roles and responsibilities related to the principles of effective shared governance.
- It is clear that transparency by both administration and faculty are mutually desirable but also unclear what the boundaries for mutual transparency are.
- At the same time, there appears to be some generalized expressions of "institutional transition fatigue," uncertainty about where the institution is headed, and how that will impact individuals on a personal and professional level.
- As a backdrop to all of this, active efforts to unionize the faculty are underway.
- The Provost is attempting to move the institution forward by working with faculty to realize their full potential. He is also perceived as being in a difficult position and lacking some of the infrastructure in the Office of the Provost to make the kinds of changes that need to occur to support the President's vision. Expressions of suspicion of motivations flow in both directions between academic administration and Faculty Senate leadership, some of the latter of whom believe the contributions they have made to the institution and the traditions that served it well in the past are being discarded. One concern expressed by several individuals is the perception that administration, faculty and staff have historically been living within the "Oregon Tech bubble" that might suggest some are largely insulated from the volatility of the larger higher education ecosystem and questioning the need for institutional change and departure from those earlier traditions.
- It is unclear the degree to which the academic priorities of the administration are well understood (and accepted) by the Faculty Senate leadership or by the faculty at large. It is also unclear the degree to which there is a "strategic change management" process or plan in place to create understanding and acceptance of academic realities and academic priorities, and a prioritization of those academic priorities (i.e. those priorities which can be accomplished first with the least expended capital). A contributing factor to the absence of priorities and lack of understanding about their importance has been the number of high level academic interim positions left unfilled over the last several years.
- The academic administration is lean by comparison to other institutions of similar size and complexity, and key positions (deans, department chairs) are vacant. This lack of support in the Provost's office is further stressed by the fact that the Board, President, Provost, and other members of the leadership envision placing the institution on a trajectory to increase enrollment (and, thus, revenue), raise the institution's profile to

national prominence, and enhance the brand and reputation academically. The infrastructure and personnel required to do this effectively are currently missing in the Provost's office.

- Effective academic leadership to transition the institution will be critically dependent upon strengthening academic leadership with strong deans and department chairs. Historically, there has not been a model or system in place to support chairs in a way that will help them function more operationally and strategically as academic leaders.
- This lack of support infrastructure creates a situation in which the critical academic leadership and support infrastructure is suboptimal and needs attention. Hence, strategic change management suffers and the Office of the Provost is forced to tend to more tactical issues of a daily operational basis at the expense of strategic change.
- As the President's leadership team, which is new, begins to gel as a team over the course of the next year, many of the uncertainties about institutional priorities and direction should dissipate.

Recommendations

- Continue work to nurture an institutional culture of effective shared governance that manifests in a two-way, symmetric fashion **trust, collaboration, communication, transparency, inclusiveness, honesty, and integrity.**
- Establish clarity on deans' and department chairs' roles and responsibilities and fill those positions as soon as possible. In the case of both deans and department chairs, they need to be provided clear direction on the academic imperatives and the authority, responsibility, and accountability for achieving those imperatives.
- Staff the office of the Provost adequately to support the academic strategic agenda.
- Recognize that the overarching challenge is "strategic change management" and dedicate resources to develop the strategy and the processes to effectively build and sustain a culture of academic excellence.

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ACCREDITATION TIMELINES

COLLEGE OF HAS

Name of Accrediting Association	Program(s) Accredited	Date of First/Last Accreditation	Accreditation Status Award	Self-Study/ Interim Report Due	RFE Visit/Report must be Submitted by:	Date of Visit	Accredited to:
<u>CoAPSG</u> <u>CAAHEP</u> (Commission on Accredited of Allied Health Education Programs)	Polysomnographic Technology	2008 3-18-2011	Continuing Accreditation	Annual Report 1-31-18 Self-Study 1-2020	Comprehensive <u>eval</u> & onsite review – no later than 2021	Within 6 <u>mos</u> of Self-Study	2021
<u>CoARC</u> <u>CAAHEP</u>	Respiratory Care	10-11	Continuing Accreditation	Annual Report 7-1-14 Self-Study 1-2020	Comprehensive <u>eval</u> & onsite review Notification in July 2019	No later than 2021	7-31-2021
<u>CoAEMSP</u> <u>CAAHEP</u>	Paramedic Education	2000 2012	Continuing Accreditation	Annual Report 9-1-17 Review appendix G 7-1-19	Comprehensive <u>eval</u> & onsite review	2018	Continuing
<u>CODA</u> (Commission on Dental Accredited – American Dental Association)	Dental Hygiene	2002 11-2010	Approval without reporting requirements		NA	2023	Ongoing
<u>NAACLS</u>	Clinical Lab Science (CLS)	2000 2015	Continuing Accreditation	Self-Study 10-1-2020		SP 2021	10-31-2021
<u>CAAHEP</u> <u>JRCEDMS</u> (Joint Review Committee on Education in Diagnostic Medical Sonography)	Diagnostic Medical Sonography	9-15	Initial Accreditation	<u>Rept</u> Findings 6-22-2015		5/11-12 2015	9-30-20
	Vascular Technology	9-15	Initial Accreditation				9-30-20
	Echocardiography	9-15	Initial Accreditation				9-20-20

*In process of updating accreditation status

ACCREDITATION TIMELINES

COLLEGE OF ETM

Name of Accrediting Association	Program(s) Accredited	Date of First/Last Accreditation	Accreditation Status Award	Self-Study/ Interim Report Due	RFE Visit/Report must be Submitted by:	Date of Visit	Accredited to:
ABET – ETAC (formerly TAC) Engineering Technology Accreditation Commission	Computer Engr Tech (AE)	1970 14-15	Accredited	Self-Study due 7-1-20	1-31-20	F 14	9-30-2021
	Computer Engr Tech (BS)	1970 14-15	Accredited	Self-Study due 7-1-20	1-31-20	F 14	9-30-2021
	Software Engr Tech (AE)	10-1-07 14-15	Accredited	Self-Study due 7-1-20	1-31-20	F 14	9-30-2021
	Software Engr Tech (BS)	1991 14-15	Accredited	Self-Study due 7-1-20	1-31-20	F 14	9-30-2021
	Electronics Engr Tech (BS)	1970 14-15	Accredited	Self-Study due 7-1-20	1-31-20	F 14	9-30-2021
	Embedded Systems Engr Tech (BS)	2012 14-15	Accredited	Self-Study due 7-1-20	1-31-20	F14	9-30-2021
	Manufacturing Engr Tech (BS)	1985 14-15	Accredited	Self-Study due 7-1-20	1-31-20	F 14	9-30-2021
	Mechanical Engr Tech (BS)	1970 14-15	Accredited	Self-Study due 7-1-20	1-31-20	F 14	9-30-2021
ABET – ASAC Applied Science Accreditation Commission	Geomatics (BS)	1985 12-13	Accredited	Self-Study 7-1-18	1-31-18	F 18	9-30-2019
ABET – EAC Engineering Accreditation Commission	Civil Engineering (BS)	1998 16-17	Accredited	Self-Study 7-1-22	1-31-22	F 16	9-30-2023
	Electrical Engineering (BS)	2010 16-17	Accredited	Self-Study 7-1-22	1-31-22	F 16	9-30-2023
	Mechanical Engineering (BS)	10-1-07 16-17	Accredited	Self-Study 7-1-22	1-31-22	F 16	9-30-2023
	Renewable Energy Engineering (BS)	09-10 16-17	Accredited	Self-Study 7-1-22	1-31-22	F 16	9-30-2023
IACBE International Assembly for Collegiate Business Education	Management (BS), with options in: Accounting Entrepreneurship/Small Bus Marketing	14-15	Accredited	Self-Study 2020-21			Dec. 2022
	Information Technology (BS), with options in: Accounting Applications Development Business/Systems Analysis Health Informatics	14-15	Accredited	Self-Study 2020-21			Dec. 2022
	Operations Management (BS)	14-15	Accredited	Self-Study 2020-21			Dec. 2022

ABET does not accredit Masters Degrees – they're under NWCCU AE Associate of Engineering BS Bachelor of Science BAS Bachelor of Applied Sciences



ACCREDITATION TIMELINES - INSTITUTIONAL

Last Update: 11/3/2018

Accrediting Association	Program(s) Accredited	Date of First Accreditation	Date of Last Accreditation	Accreditation Status Award/Notes	NWCCU Seven-Year Accreditation Cycle (Began 2017-18)	Corrective Action/Status	RFE Visit/Report Must Be Submitted By	Date of Last Visit	Date of Next Visit
NWCCU	Institutional, as a whole.	1962	SP 2016	Full Accreditation Reaffirmed	Due Spring 2017 Standard 1 Report Mission, Core Themes			SP 2016	SP 2019 Mid-Cycle Evaluation 4/15-16
				<u>Rec. 1 and 2 do not meet criteria for accreditation 7/3/16</u>	Due Spring 2017 Ad Hoc Report to Address Recommendations 1 and 2 of SP 2016 Year Seven Peer-Evaluation Report	Commission accepted Recommendation 1 7/3/17			NA
					Due Fall 2017 Ad Hoc Report to address Recommendation 2; must be resolved within 2 year period; Notice of Concern issued	Recommendation 2 in compliance 7/3/17			NA
				<u>Rec. 3, 4, 5 in compliance but need improvement 7/3/16</u>	Due Spring 2019 Ad Hoc Report to Address Recommendations 3, 4, and 5 of SP 2016 Year Seven Peer-Evaluation Report				NA

Seven Year Cycle Breakdown

SP 2017	Standard 1 report due Report on Mission Statement, Core Themes, Goals, and Outcomes. Expectations are established and we must identify how we will meet those expectations. This will set the stage for everything that happens in this seven-year cycle.	
SP 2019	Standard 2 report due	
SP 2020	Standard 3 report due Planning and Implementation	Standard 4 report due Effectiveness and Improvement (assessment)
SP 2022	Final Report due; site visit Mission fulfillment, sustainability, adaptation	
2023	Seven-year cycle starts over; establishing a continuous process	

DISCUSSION

Agenda Item 4.2

Summer Grant Projects and Sabbaticals Report

Background

During the 2017-18 academic year, the Provost Leadership Team (PLT) reinstated and sought proposals for summer 2018 creativity grants from members of the faculty. The PLT focus is to fund faculty projects that will support the strategic vision and direction of Oregon Tech, and generate momentum toward realizing strategic departmental, college and university goals. Funding will support and special consideration is awarded to projects that focus in the following areas:

- a. **New project and program development/ modification of existing programs or space**
 - i. Interdisciplinary/trans-disciplinary – crosses departmental boundaries
 - ii. Cross college opportunities- involves faculty from both Colleges in a substantial way as co-producers of new programming
- b. **Unit development/efficiencies improvement that are implementable in AY-'18-'19**
 - i. New method(s) of spurring revenue growth and development
 - ii. New method(s) of controlling or containing costs
- c. **Professional development**
 - i. Support of faculty in external facing creative activities
 - ii. Project-based learning-integration of pedagogy and student-centered research project into the teaching environment
 - iii. Promoting innovation and intra-/entrepreneurship for faculty and/or students
- d. **Creating new opportunities for expanding student demographics and/or revenue generation**
 - i. Development of new curricula which will bring new ways to reach students- certificates, badges, etc. which will expand our capacity to attract new students
 - ii. Modification of Existing programming to reach a broader range of students

At the end of the summer, faculty are required to submit a report to the PLT.

Recommendation

None. Item is informational only.

Attachments

- [2018-19 Sabbatical Summary](#)
- [Summer Creativity Grants Summary](#)
- [Summer Creativity Grants - Final Reports](#)

2018 -19 Sabbatical Summary

Funded Sabbaticals for Academic Year 2018-19						
Dept	Last	First	Dates Applied For	Sabbatical Dates	Purpose	
CE	Lindgren	Roger	9/15/18-3/20/19	9/17/18-3/22/19	Further enhance knowledge in two key areas of professional sub-disciplines - active transportation and urban transportation	
EERE	Torres Garibay	Claudia	9/17/18-6/15/19	9/17/18-3/22/19	Development of courses relevant to the BSREE and MSREE programs. Actualization on materials scienc research with focus on energy production materials. Andragogy training.	taking leave for 3rd term
EMS	Kennel	Jamie	9/1/18-4/30/19	9/17/18-3/22/19	Conduct primary research in EMS; make substantial progress toward completion of a dissertation in order to complete a PhD in medical sociology.	
HSS	Neupert	Mark	9/17/18-6/15/19	9/17/18- 6-30/19	Conduct ethnographic fieldwork and film-making in Leiden, the Netherlands. Dr. Neupert began his research in exploring urban planning in a uniquely European city, Leiden. He has the support of the City and is working with city planners and University of Leiden.	will co-serve as Chair and take off entire academic year
MGT	Neupert	Hallie	9/17/18-6/15/19	9/17/18- 6-30/19	Pursue continuing ed and build community and industry relationships to support Oregon Tech's budding Innovation & Entrepreneurship culture, facilitate faculty/student engagement in community based projects, and engage in local economic development efforts. Research European models and experiences around university/corporate interactions, including the challenges, risks, strategies, and methodologies implemented.	will co-serve as Chair and take off entire academic year
MMET	Demeshko	Irina	9/17/18-6/15/19	9/17/18-3/22/19	To work on professional development in four categories: strengthen industry connections; enhance technical skills related to CAD; pedagogy; and connection with peers through professional associations	
NSC	Hughes	Michael	1/7/19-6/16/19	9/17/18- 6-30/19	Pursue appt as visiting professor at Univ of Western Australia- willl conduct environmental research aligned with his supported work here at OIT.	will work on grant-Fall term-funded by BLM grant

Summer Creativity Grants Summary

Summer Creativity Grants 2018										
Who	Who2	Title	Product	Requested Award	Use of funding 1	Use of funding 2	Other use	Match	Funded	%
David Hammond		Course development. A web-based model electricity market for teaching economics of electricity markets	software product	\$ 4,878.00	salary 90%	other 10%			\$3,000.00	61.50%
Grant Kirby		Aligning on-line hybrid courses	Presentations on programming efficiencies	\$ 4,072.00	salary 60%	software 40%	travel		\$3,000.00	73.67%
Sharon Beaudry, Tracey Coon	Jeff Dickson	Grant/Funding source ID and Execution: To build department infrastructure to support future college of business	needs analysis	\$ 4,559.95	salary-Beaudry, Dickson,	Coon; Travel		Dept. \$500	\$4,500.00	98.69%
Wangping Sun	Yanqing Gao	Algorithm to implement the datum-based model for practicing geometric dimensioning and tolerancing	development of algorithm	\$ 5,000.00	salaries				\$4,000.00	80.00%
R. Overholser, J. Reid	K. Davis J. Dickson	Development of a BS in Data Science	Data Science program	\$ 5,000.00	faculty salary	Big Data			\$4,000.00	80.00%
C. VanRooyen	Terri Torres	Establishing an Apiary	UG research	2258.86	materials				\$2,258.86	100.00%
John Borgen		Development of Mindfulness Curriculum	M.T. Curriculum across	\$ 4,500.00	conference	auxiliary expenses	travel		\$3,800.00	84.44%
Amber Lancaster	Franny Howes	Mobile usability lab and client partnership development	mobility lab - campus wide	\$ 4,995.21	equipment	travel			\$4,000.00	80.08%
Yasha Rohwer		Ethics-GenEng	academic papers	\$ 5,000.00	salary	travel			\$4,000.00	80.00%
Steve Addison	Don Lee	Virtual Labs	Feasibility study	\$ 5,000.00	salary - Lee 70%	travel - focus groups		LWIT - lend two licenses Boeing \$4000	\$4,000.00	80.00%
Don Lee		Program development	Robotics Program	\$ 4,950.00	salary 54%	equipment			\$4,000.00	80.81%
Matt Schnackenberg		Gorgia's encomium	Video education resources	\$ 5,000.00	Linkville	faculty salary			\$3,500.00	70.00%
Matthew Sleep		Drone-based imagery		\$ 807.00	salary	travel			\$807.00	100.00%
Sean Sloan		Biomedical minor	catalog	\$ 5,000.00					\$0.00	0.00%
Eklas Hossain		Enhancing management	personal preparation	\$ 5,000.00	ACE	HBS	travel		\$0.00	0.00%
TOTAL				\$ 66,021.02					\$44,865.86	

2018 Summer Creativity Grants Final Reports

2018 Summer Creativity Grant Final Report

Project Title : A web-based model electricity market for teaching economics of electricity markets

Project Lead : David Hammond, Mathematics

Introduction and overview:

The stated goal of this grant application was to complete the development of a polished, easy to use and engaging web-application software for simulating an electricity market. In this model students play the role of market participants, each owning a fleet of electricity generators of different types (e.g. coal, nuclear, and/or natural gas), and submitting bids stating the prices at which they are willing to sell electricity. The model electricity market is organized into a set of distinct bid rounds, each representing a single day. Each such "model day" is subdivided into separate time segments, which are used to represent variability in demand for electricity at different times of day. At the end of each bid round, the market is "cleared" based on the accumulated bids of all market participants and the actual electricity demand, i.e. the market price is determined for each time segment such that dispatching capacity from all generator units at or below the market price exactly meets the demand. Finally, students should be able to view the dispatch for their generator units in each bid round, and compute their total profits or losses based on revenue from selling electricity, and costs of running their generators (including both fuel costs, maintenance costs, and fixed costs). The overall activity may be presented as a competitive game, where students seek to maximize their total profit.

Before summer 2018, a version of the web application software had been developed which automated and enabled many of the tasks involved in running the model electricity market. In particular, this basic functionality allowed users to log in and upload their bids as spreadsheet documents, allowed the administrator to clear the market and compute dispatch, and allowed users to download a report indicating which of their generators was dispatched. However, the software was not easy to configure and install, was not visually attractive, and was missing many features such as automatic computation of profit and loss that are important for improved usability in a classroom setting.

The objectives of this grant project focused on further development of the application, with an emphasis on simplifying configuration and improving ease-of-use. This software was renamed MAGE (for Market Analysis Game for Electricity). At the time of this report, most of the stated deliverables of the original grant application have been met. These are detailed below.

Stated Deliverables and reported progress:

"researching deployment on commercial cloud infrastructure"

This deliverable was successfully completed. The stated goal was to determine automated methods for deploying the web application on commercial cloud infrastructure. This was done using both the Amazon Web Services elastic compute cloud (EC2), and the Atlassian Bit Bucket platform to store the MAGE source code repository. A set of command-line shell scripts were developed such that automatically deployed an Amazon EC2 machine instance, installed all of the necessary software dependencies, downloaded the MAGE software using the git version control software, and launched the MAGE application. Using these scripts, the entire process of bringing up a web-server, configuring it and deploying the application takes fewer than two minutes, given that the user has access to an Amazon Web Services account.

A portion of the budget for this grant was spent on a so-called EC2 reserved instance for a single year, which enables a platform for running the MAGE application for the coming year. It is anticipated that this will be used in Winter 2019 as part of the REE 425 (Electricity markets and modeling) course.

"[develop an] automated tool for creating and assigning power plants to the appropriate set of users ... within the web interface"

This deliverable was successfully completed. The characteristics of each of the power plants, including assignment to users, are represented internally within the MAGE application by a data structure called the Master Generator Fleet description. Implementing this deliverable consisted of adding a page called the Master Generator Fleet Description Creation Tool. This page first allows specification of a so-called profile set (a specially formatted spreadsheet describing each of the different categories of possible power plants, e.g. coal, nuclear, combined cycle or combustion turbine), and a set of usernames which may be automatically imported from the current simulation configuration. Once these two are specified, a second page allows entering the percentage of total capacity for each of the power plant categories, as well as the total number of megawatts per user (see Figure 1). The master generator fleet description can then be automatically generated by the web application and used to configure the market simulation. This entire process can be done through the web interface, without explicitly uploading or downloading any

spreadsheet files, greatly speeding the configuration.

MaGE. Logged in as: hjc. Market simulation: default. Current time is 09/11/2018 15:28

Master Generator Fleet Description Creation Tool (page 2 of 2)

Current simulation : Master generator fleet description is not loaded. [Browse...](#) No file selected. [upload](#)

Available Master Generator Fleets : [biogas_default_users_mgf](#) [View](#) [Delete](#) [Download](#) [Select for current simulation](#)

Using generator types from profileset **default**, and users from usernameset **default_users**

Specify fraction of total generation capacity for each generator type, and MW per user

Coal percentage

Combined Cycle percentage

Combustion Turbine percentage

Nuclear percentage

Megawatts per user :

Create new Master Generator Fleet [generate](#)

[Main Page](#) | [Logout](#) | [Admin Market Configuration](#) | [Admin Market Console](#) | [Admin Market Simulation List](#)

Created new master generator fleet with name default_default_users_mgf

Figure 1 | View of the Master Generator Fleet Description Creation Tool

"automatic generation of an entire set of forecast market conditions (fuel prices and electricity demand) and actual market conditions for the entire game"

This deliverable was successfully completed, by adding the "Market conditions edit tool" page (see Figure 2). The forecast and actual market conditions are data structures that specify the prices of each fuel type, and the electricity demand (in MW) for each time segment of the model day. The forecast values are accessible by the regular users before they submit their bids, and are intended to provide information needed for users to calculate appropriate bid values. The actual market conditions contain the price and demand values that are actually used when the market is cleared, and for purposes of computing profit and loss. Prior to developing the "Market conditions edit tool", the forecast and actual market conditions were set by uploading specially formatted spreadsheet files containing this information, which was a time-consuming process. With the developed tool, the administrator may directly enter values for the forecast prices and demands, and enter a percentage range for each price or demand value. Then, the actual market conditions can be automatically resampled by varying the forecast values by a random fluctuation determined by the given percentage range. Once all of the values are filled, they may be saved to any specified bid round. This edit tool enables much more rapid specification of the market conditions data structures, while still allowing for them to be downloaded and uploaded as spreadsheet files, if desired.

MaGE. Logged in as: hjc. Market simulation: default. Current time is 09/12/2018 09:19

Market conditions edit tool

Load from bidround : 1

Resample actual values from forecast :

Set all resample percentage ranges to 10 % :

Forecast		Actual		Resample percentage range
Coal	\$/MMBTU	Coal	\$/MMBTU	10
Natural Gas	\$/MMBTU	Natural Gas	\$/MMBTU	10
Nuclear	\$/MMBTU	Nuclear	\$/MMBTU	10

Maximum total generation capacity for all generators in market is 2850 MW (not considering forced outages)
Average total generation capacity for all generators in market is 2607 (considering forced outages)

Forecast		Actual		Resample percentage range
off-peak am	MW	off-peak am	MW	10
daytime 1	MW	daytime 1	MW	10
peak	MW	peak	MW	10
daytime 2	MW	daytime 2	MW	10
off-peak pm	MW	off-peak pm	MW	10

Save as bidround : 1

[Main Page](#) | [Logout](#) | [Admin Market Configuration](#) | [Admin Market Console](#) | [Admin Market Simulation List](#)

Figure 2: Market conditions edit tool

"automatically compute profit and loss for each individual market participant, and visualize this information for the web application administrator"

This deliverable was successfully completed. Functionality was added to compute the profit or loss for each individual, for each bid round, and to create a report containing this information that can be rendered either as an HTML table and viewed by the administrator (typically the course instructor) from within the web application, or downloaded and viewed as a spreadsheet file. In addition to the overall profit or loss for each participant, detailed information for the revenue and operating costs of each power plant are included in the report structure. Furthermore, a configuration option was added so that the ability for each regular user (typically a student) to view this information may be either enabled or disabled. When enabled, each regular user may view the revenues and operating costs of each of their individual power plants, enabling them to see quickly and clearly where their overall profit or loss is coming from. The option to disable this functionality was included so that the course instructor may, if desired, require students to go through process of performing these calculations themselves.

"functionality will be developed so that the supply curve (i.e. total electricity available to sell at or below a given price, as a function of price) can be inferred automatically from the submitted bids, and visualized"

This deliverable was successfully completed. Functionality was added within the web interface to generate supply curves from the data already stored as the overall market report, which is created whenever the market is cleared for a bid round. The administrator may now simply select desired the bid round and time segment and click on the "visualize supply curve" button, and a graph showing the supply curve (i.e. supply available as a function of price), as well as a horizontal line showing the actual demand for that time segment (see Figure 3). These graphs illustrate how the market clearing price is conceptually given by the intersection of supply and demand curves, which is a fundamental concept in economics.

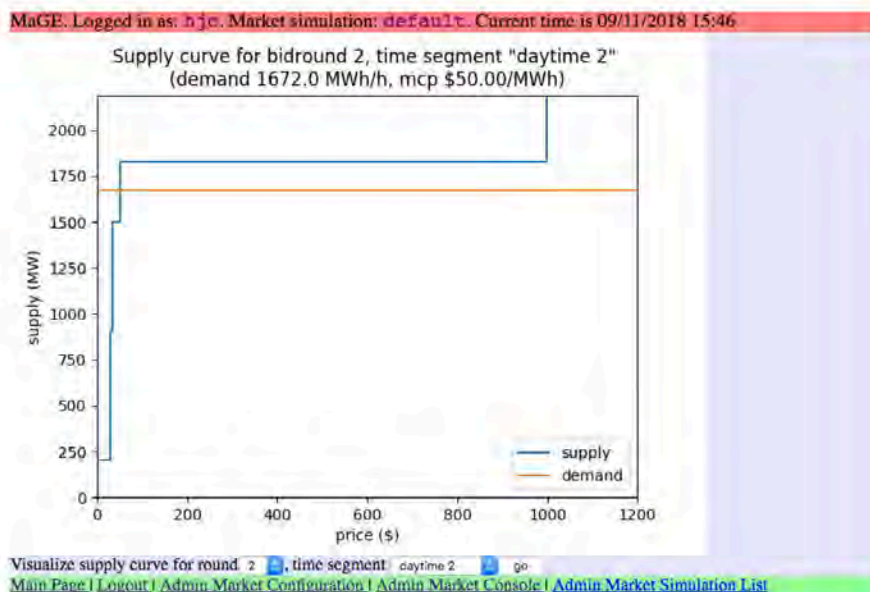


Figure 3 : Example supply curve as produced by MAGE.

"The visual aesthetic of the web application will be improved, and branded with visual elements highlighting Oregon Tech"

This deliverable has been partially completed. I have contacted an illustrator who is currently (as of 9/28/2018) working on logo artwork for the MAGE application that will incorporate the Hootie owl mascot and graphic elements indicating electricity. The illustrator has provided preliminary sketches and is in the process of completing the final illustration based on my feedback about those sketches. However, as of this writing the logo artwork has not been completed. In addition, the redesign of the CSS code to consistently use Oregon Tech's school colors has not been completed at this time.

Summer Creativity Grants- Summer 2018

To: Gary Kuleek, Dede Williams

From: Grant Kirby

Date: 6/13/2018

RE: Final Summer Creativity Grant Summary report

Project Summary

When developing a series of courses that are related in content, it is critical to track the objectives and outcomes of those courses so that students get the right amount of topic reinforcement without excess redundancy. There is substantial literature that points to the need of have clear, measurable course and module objectives that are specifically serviced by the assessments used to measure success against those objectives. Given that courses are developed by different faculty across time, it is difficult to establish and maintain course objectives that stay consistent across courses, particularly those technology courses that are always in a state of change to keep up with current technological trends. In particular, this project focuses on the design and development of online courses, but the concepts discussed relate to on-ground and hybrid classes as well.

There are multiple course development scenarios where accurately tracking objectives and their related assessments would allow faculty to maximize the effectiveness of each course. These scenarios include

1. Aligning online courses with the Quality Matters rubric
2. Assuring all courses in a related series have the right objectives and related assessments across the series
3. New program development where faculty have a unique opportunity to align and track all new courses from the outset (i.e. Cyber Security program)
4. Revising an existing program to better reflect industry and student needs (i.e Information Technology program in the Management department).

Many faculty have worked up rudimentary models to help them see how course objectives and their associated assessments align across the course and perhaps their whole program. These home-brew tools are not scalable, nor do they provide advanced information analytics designed to show faculty opportunities to grow programs based on accurate course data. If this task is complicated for a single course, it is very difficult across courses within a program. It is also desirable to be able to use course data to view those data from multiple points of view. For example, I might want to see how a particular objective is matured across a series of classes, and then I might want to start with a particular objective and see which classes have elements of that objective (i.e. principles of ethics spread through coursework).

This project used a software tool called **Coursetune™** as a course objective modeling tool that scales from individual instructor/single class analysis to multiple university-wide course assessments with many instructors and course reviewers. The purpose of this summer grant was to evaluate the courses I teach to show the linkage between course/program/department objectives and the activities deployed in the course. The underlying principles of the course design incorporates the standard design elements of the **Quality Matters Rubric™ (QM)**. In this project I needed to obtain a license for the Courstune cloud-based software. Then bring my courses into the tool as an example of how the tool could help the Management Department to design in quality metrics for all online courses offered from the department.

Project Results and Analysis

Across the summer I was able to load the five courses I routinely teach into the model environment. I then set up the objectives and activities that support those objectives. The courses used in the project include:

- MIS 113 – Intro to Relational Databases
- MIS 206 – Intro to Management information Systems
- BUS 304 – Engineering Management
- MIS 312 – System Analysis I
- MIS 322 – System Analysis II

As identified in the syllabus, I identified a high-level objective for each week. Figure 1 shows these high-level objectives assigned to my MIS 322 .

Course Learning Objectives

- CLO 1: Evaluate the principles of UML in the context of a software development project
- CLO 2: Demonstrate the ability to turn use case into a set of system requirements
- CLO 3: Describe precise business processes through the use of functional modelling techniques
- CLO 4: Develop structural models from functional models and other data sources
- CLO 5: Demonstrate ability to validate and verify class diagrams from previous models
- CLO 6: Create and evaluate behavior models from structural and functional models
- CLO 7: Develop design plan based on analysis models
- CLO 8: Finalize class diagram model
- CLO 9: Convert class diagram to RDMS system design
- CLO 10: Design and defend human computer interface model

Figure 1: Course Learning Outcomes

Then each weekly module is assigned 2 or more sub-objectives referred to as student learning outcomes (SLO). These SLOs are more specific than the CLOs and specify the desired outcomes of the week's work. Figure 2 shows MIS 322 in model form. A shorthand version of the SLOs for each week aligns with each week's icon (i.e. Week 1). Each Week is assigned some number of student learning objectives with an option of identifying some learning objective rating system (i.e. Blooms Taxonomy) as indicated in the left column of Figure 3.



Figure 2: MIS 322 course with SLO's by Week

Title	Description	ID
SDLC review	1.0 Evaluate the principles of UML in the context of a software development project	Week 1
LO Scale	LO ID	Learning Objective
2	SLO 1.1	SLOs 1 Identify the basic characteristics of Object oriented systems.
2	SLO 1.2	SLOs 2 Demonstrate a basic knowledge of the Unified Modeling Language.
1	SLO 1.3	SLOs 3 Recognize the SDLC elements within the Planning Phase.
1	SLO 1.4	SLOs 4 Form working teams.

Figure 3: Week 1 SLOs with LO taxonomy

Given that this course is divided into weekly modules, there are various activities assigned to the student across the week that align with one or more SLOs identified for that week. The idea in course design is that every assignment, assessment or other activities must be used to measure specific objectives so that the course objectives and workload are aligned. Coursetune allows the developer to identify many different kinds of activities that can be employed in the course.

It turns out that while any given course will have a set of unique objectives, there are also required alignments across various scales of objectives to satisfy higher level constraints. For example, in addition to the course and student learning objectives, my classes need to align with various other sets of objective mappings. There are program level objectives, departmental objectives and objectives aligned the requirements of accreditation. Figure 4 shows how the first of the IACBE accreditation objectives are reflected across the course.

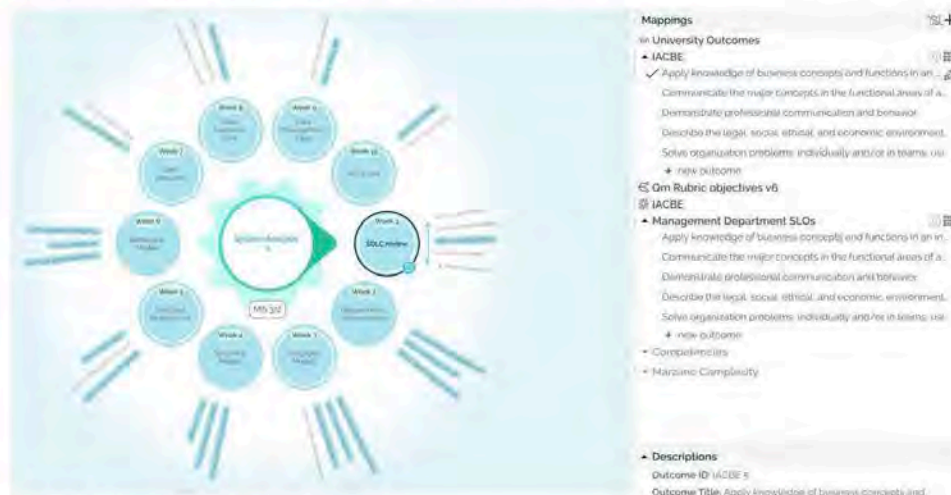


Figure 4: IACBE mappings for MIS 322 1

Figure 5 shows the same objective mappings across the five course I currently teach. This feature allows accreditation and assessment people to see how objectives are serviced across a large number of courses at a glance.



Figure 5: IACBE obj across 5 classes 1

By assigning all course activities to particular student learning objectives, the course developer can assure that every activities in the course is aligned with one of more objectives. This allows the designer to make sure that students are not getting busy work that does not relate to the objectives of the course. It also helps verify if there are objectives that have activities to measure competencies for that particular objective/outcome.

Coursetune provides a disceptively simple interface to show how the content of the course is used to measure desired outcomes. Loading the meta-data of a particular course into Coursetune is relatively simple, but the advanced modeling and system reporting tools provides deep insight into the how the design of the course is achieving desired objectives for the students.

Outcomes, Conclusions and Next Steps

The exploration of Coursetune has provided an indepth look at the classes that I currently teach. I have learned how to populate the models and how to look for gaps in my courses. Taking the QM certifications has taught me the importance of solid design and especially the need to align all activities with the identified objectives of the course. Coursetune allow me to see all of my classes at a galnce and then to identify how individual objectives play across one or more classes. The most important outcome of this project for me is being able to build consistency into my classes, which I believe will translate into a much better product for my students. The forcing function required to build out these course models introduces a discipline that helps me to design courses from scratch and to end up with a solid design.

Part of my agenda for taking on this project is to create a realistic set of models that can be used by the rest of the faculty and adjuncts in my department to set out on a trek of continuous course improvement across the department. The ideal outcome would be for our department to see the benefits of of this type of course/program modeling and to embrace the need for well designed courses that satisfy the objectives of the program and the department.

A third, and perhaps more important, outcome is using my course models to show how this structured model platform can be used in both assessment reviews and in accreditation. The scalable views of the models are perfect for those who need to use assessments to improve the quality of our courses and to communicate to various accreditation bodies who need to review the very connections shown clearly in the models.

This grant allowed for myself and others involved with distance edu, assessment and online course development. We have a 1-year license for 5 seats. My hope is to convince my department, distance ed and those involved with campus-wide Assessment, to use this tool as a way to increase the design capacity of quality online classes and to be able to demonstrate the effectiveness of these courses to external interested parties. I would hope that Oregon Tech would make additional licenses available across the organization to help their faculty and adjuncts create solid course products. In particular, this kind of modeling would be a bonus for departments going through accreditation processes.

In summary, it is my opinion that this is one of those course modeling tools that can significantly increase the levels of productivity for course developing faculty, and will reduce the burden to the department in executing their medium to long range program design.

Summer Creativity Grant

Grant/Funding Source Identification and Execution: To Build Department Infrastructure to Support Future College of Business at Oregon Tech

I. Project Summary

The Problem Being Addressed

The current labs that support the Business Management department in Klamath Falls are inadequate and ill-equipped to meet the needs of the updated programs being offered. Specifically, the programs have difficulty in scheduling to meet all needs, outdated equipment, a lack of remote delivery, and an overall unappealing esthetics that do not attract new students. These problems not only affect the quality of instruction, but more significantly the student experience. It is frustrating at best, and at worst we teach students on equipment that is decades old and no longer used in industry. Online students often drop classes because they have significant difficulties when installing software required for the class.

Envisioned Labs

Through this grant, the department sought to identify grant funding and/or industry partners to support the modernization of the labs. Business schools across the country have been creating technologically advanced and inviting spaces to attract and retain students to their programs. These include full-blown simulation labs with custom desks, computers with multiple displays, and attention walls with wall-mounted digital stock tickers, LED boards, world clocks, and LCD screens. According to Rise Display (2017) nearly 25% of business programs now have a business showcase lab.

Project Details

The goal of the project was to update the department infrastructure. The following was addressed with this Summer Creative Grant:

- **Needs Analysis.** The project team met to understand the details of the Wilsonville campus Cyber Center implementation and infrastructure. This included a review of industry partners as potential partners for the Klamath Falls campus. Moreover, the group determined needs for the long-term success of the department's infrastructure.
- **Identification of Grant and Other Funding Sources.** Once the needs were determined, a search of government and private grants was completed for the best match. Several sources have been uncovered:
 - National Science Foundation Advanced Cyber-Infrastructure Funding Opportunities
 - Hewlett Foundation Cyber Grants
- **Other Funding Sources.** Additionally, the team identify process to identify industry partners to find other ways to meet equipment needs.

II. Project Results and Analysis

- A. **Needs Analysis:** The group worked together to develop an analysis of current needs of labs to support department curriculum and the future College of Business. The specific needs include creating technologically advanced and inviting spaces to support the business programs. Our goal is to update the following:
- a. **OW112 Network/Cyber Lab.** Create an inviting lab that supports the IT program for networking and cyber courses. Optimally, a door and window will make this space accessible from OW206.
 - b. **OW206 Computer Lab.** Since this lab mainly supports the Business Management department, the goal is to significantly update this space with a new layout, projector or monitors, and whiteboards.
 - c. **Showcase Business Analytics Lab.** At the North entrance of Owens, the department seeks to develop a showcase Business Analytics lab. The goal of this space is to create an inviting presence with a glass wall that adds labs space, supports the programs, and serves as a recruitment tool. According to Rise Display (2017) nearly 25% of business programs now have a business showcase lab.
 - d. In addition, a **Data Center lab** space has been identified in the new CEET building which is a great opportunity for the department to host a teaching lab that also functions as a service to the local community.
- B. **Identification of Funding Sources**
- The group took a number of different approaches to discover funding sources including:
- a. **Internal Champions:** Members met with internal colleagues to share the justification, goals and funding needs for the College of Business and the needed lab infrastructure (This included Brian Fox, Erica Veth, Stephanie Pope, Eric Johnson and more). This process developed support and shared ideas for funding.
 - b. **Development/Alumni Office:** Members met with Krista Darrah in the Alumni office. This discussion solidified the process for developing potential donors as well as grants the Alumni office was working on that could include our needs. We were also asked to share our social media campaign content with the alumni office to develop alumni support.
 - c. **Office of Government and Industry Partnerships:** We also met with Britney Miles who provided a connection to the Technology Association of Oregon. She suggested that this would be a good way to develop industry partnerships. Britney also believed there was no process at the state level for becoming a College of Business.
 - d. **Information Technology Services:** We also discussed our vision with Dr. Jim Jones who has agreed to partner with us to develop solutions. This summer he included a new projector and whiteboards in OW206 as part of the classroom upgrade process.
 - e. **Office of Sponsored Projects:** We spent much of our time working with Barbara Neil to identify grants that closely met our needs. These included the identification of two NSF grants. Once identified, we developed a

short summary of a research project that might be meet the requirements of these grants. Below-

***Oregon Tech Cybersecurity:
Developing the Next Generation of Cybersecurity Experts***

Oregon Institute of Technology (Oregon Tech), Oregon's public undergraduate university, has a history of strong engineering, technology and business programs with campuses in southern rural Oregon and Portland-Metro. The university takes pride in our mission of delivering technology education while continually partnering with industry leaders to ensure that our programs are preparing students for workforce demands. The university has conferred approximately 1,000 bachelor degrees in the ever-changing field of business and information technology since the early 2000s.

The Nation's Cybersecurity Needs

The Executive Order on Strengthening the Cybersecurity of Federal Networking and Critical Infrastructure focuses on working with state and local government and private sector partners to more fully secure critical infrastructure to improve the Nation's cyber capabilities in the face of intensifying cybersecurity threats. As such, private and public sectors should align education and training programs to transform, elevate, and sustain the learning environment to grow a dynamic and diverse cybersecurity workforce.

Oregon Tech's Plan to Meet these Needs

Oregon Tech is poised to develop the next generation of cybersecurity experts to work in both private industry and government sectors including through partnerships with the U.S Air Force and Air National Guard at Kingsley Field Base in Klamath Falls. Oregon Tech is implementing a cybersecurity program that will provide bachelor's degrees and training resources in this specialized area. This curriculum and supporting infrastructure will allow for growth of the university's approach to hands-on education in the area of Information Technology and Cybersecurity at multiple locations in Oregon, as well as through online modalities for students beyond Oregon's borders.

- ***Phase One | Cyber Defense Center:*** *In the fall of 2017, Oregon Tech launched the Cyber Defense Center in the Portland-Metro campus. The center is modeled on a "teaching hospital" educational approach to address industries' challenges. The center fills a huge gap in the education and training of cybersecurity professionals with a highly effective "on the job" experience. This phase was funded through a \$350,000 grant from the Oregon Employment Department in 2015.*
- ***Phase Two | Training Curriculum***
 - ***Cybersecurity Degree:*** *Oregon Tech has developed a bachelor's degree program that combines knowledge and skills from information technology, computer science, computer engineering, and business along with specialized topics that are unique to cybersecurity. Expected to launch in 2019, the program will prepare graduates to enter the cybersecurity profession with the knowledge and skills necessary to obtain entry and mid-level positions in a variety of industries. The curriculum for the program focuses on topics identified by the National Security Agency and the Department of Homeland Security, as well as the National Institutes of Standards and Technology's NICE framework, all being essential to developing a workforce with the necessary knowledge, skills, and abilities to defend both public and private networks and systems.*
 - ***Training for Military Partners:*** *In addition, Oregon Tech has hired Cyberspace Operations Officer, Capt. Tracey Coon, a cybersecurity expert, to develop specific training to meet the needs of military partners. Through the university's relationship with the Kingsley Field Military Base, Oregon Tech plans to meet federal government training requirements, allowing the university to provide a unique training opportunity that caters to the federal government. We are seeking funding of \$500,000 through NSF18-516 for these initiatives that will include the development of curriculum along with updating of the Klamath and Wilsonville campus networking/cyber labs.*

Final Report

Beaudry, Coons, Dickson

- Phase Three | Green "Teaching" Data Center and Analytics Lab:** The final stage of the plan is to develop Green "Teaching" Data Center and Analytics Lab in 2020 on the Klamath campus. Oregon Tech seeks to serve as the primary information technology service provider for Rural Southern Oregon's small and mid-size businesses, non-profit organizations, and municipalities. Oregon Tech's unique off-the-grid power infrastructure is ideal for energy-hungry data centers. This center will also serve as a teaching center for the programs described above. This Data Center will be housed in the new Center for Excellence in Engineering and Technology which has received \$40 million in state bonding authority from the State of Oregon. We are seeking \$900,000 in funding from NSF18-513 for the Data Center and Analytics lab infrastructure that will support this undergraduate training program. Once built, program is expected to be sustainable through client service fees.

Research Team: Credentials**Oregon Tech Faculty:**

Sharon Beaudry, JD, Acting Chair for Business Management Department

Link: <https://www.oit.edu/academics/engineering-technology-management/management>

Jeff Dickson, Associate Professor, Program Director for Information Technology

Link: <https://www.oit.edu/academics/degrees/information-technology>

Mason Terry, Ph.D. Associate Professor & Director of Oregon Renewable Energy Center

Link: <https://www.oit.edu/orec>

Kris Rosenberg, Associate Professor, Networking/Cybersecurity Expert: Oversee the Portland Metro Cyber Center

Link: <https://www.oit.edu/cyber-defense-center>**Federal Collaboration/Partnership**

Capt. Tracey Coon, Cyberspace Operations Officer, Assistant Professor Network/Cybersecurity Expert

Oregon Tech Information Tech Services: Administrator

Jim Jones, Ph.D. Associate Vice President, and Chief Information Officer

Link: <https://www.oit.edu/faculty-staff/technology-services>**III. Outcomes, Conclusions and Next Steps**

New Information: Since the completion of the summer work and grant summary, additional information has been revealed about potential resources that the department could utilize that are currently housed in the Cyber Security Defense Center. It is possible that this equipment could be adequate to build out the network and cyber lab needed in Klamath Falls. Currently an internal audit is being conducted to understand the equipment content and how it should be utilized.

Reassessment of Needs: If the CDC equipment can be used to support the business management programs, the group is planning to reassess our needs and vision for labs as well as projects. Once the audit is complete the Klamath group is planning to travel to the Portland-Metro campus for this discussion (October).

College of Business Plan: We also developed a written plan for the College of Business to help attract donors. This plan includes the justification, summary and history of the department, the infrastructure needed to create a presence on the

Klamath Falls campus, marketing initiatives. A budget and funding section is still being developed. (See attached).

Follow up with Funding Sources and creating External Champions: Once we have reassessed our needs, we will follow up with the following funding sources:

- **Alumni/Donor Funding:** The Alumni office will share potential donors that might have interest in supporting business and IT. They believe that they have donors that might be interested in the Green Data Center idea. They will work with us to guide us through how to reach out. This will also likely include partnering with Dean Tom Kyser on these efforts.
- **Foundation Grants:** Development is also looking at the Intel foundation for potential sources. They think our needs are something they would be interested in. We will also explore other foundations.
- **Industry Partners:** We will reach out to the “Tech Association” group mentioned by Britney Miles. She thinks this might be a good way to start conversations with companies that might be interested in partnering with us.
- **Dr. Afjeh:** We also plan to reach out to Dr. Afjeh to seek guidance on the best funding resources for our needs.

In summary, this grant allowed our department the time to create a vision for our lab infrastructure to prepare for a future College of Business. The process of sharing our needs and vision with internal sources created energy around these opportunities. It also allowed the department to understand all the various funding sources and processes. It has set us up to take next steps to seek external champions and funding sources. Lastly, it allowed us to create a document that can be used to persuade donors.

Oregon Tech's College of Business

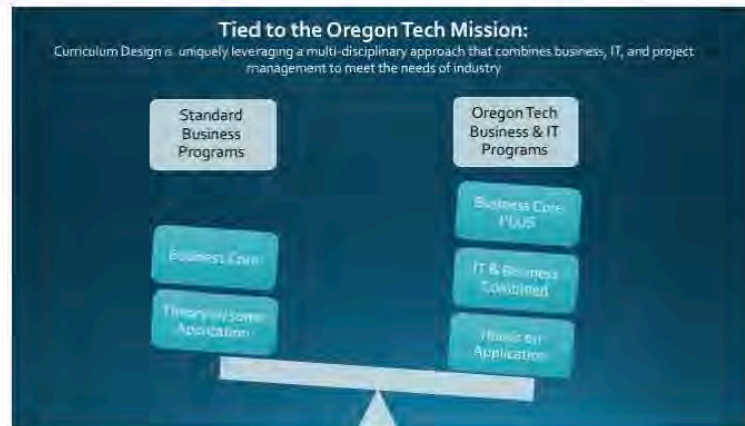


Opportunities for Growth

September 2018

The Technology-Infused Difference

Business degrees at Oregon Tech are built to meet the market needs of the future by uniquely leveraging a multi-disciplinary approach that combines business, IT, and project management. This distinctive approach goes beyond what most business programs, in Oregon and throughout the country, offer. Our programs create this



unique approach by aligning closely with the University's mission, and are therefore well positioned to meet the needs of industry. These programs are described as:

Tech-Infused Business Degrees at Oregon Tech:

Empowering graduates through innovative, hands-on, and multi-disciplinary learning experiences.

While the University is already known for its quality engineering and health programs, creating a College of Business presents an opportunity to expand Oregon Tech's current reputation and support Dr. Naganathan's goal of establishing Oregon Tech as a global leader among polytechnics and building its reputation as "*Industry's University*".

The following plan provides a framework for the development of a College of Business in order to expand the University's footprint, enhance its brand, and grow enrollment beyond the traditional engineering and medical technology fields. This is increasingly important as engineering programs move into new locations around the state including Bend and Portland. Since Oregon Tech is no longer part of the Oregon University System (OUS), it is the opportune time to establish a College of Business. This plan includes justification for a College of Business, a history of the department, plans for a technology and lab build out, and enrollment and marketing strategies. The budget is still being developed.

Why Business?

The following summarizes why Oregon Tech should invest in a College of Business:

Job Growth & Outlook

According to the US Bureau of Labor Statistics (Appendix A) the current number of jobs in business fields range from 100,000 to over 1.3 million in the United States. Overall, these numbers are far higher than fields related to other Oregon Tech degrees. Moreover, the average projected growth of business fields in the next ten years is 16%, while engineering and medical fields average only 8%.

Business fields are expected to grow at a rate of 16% in the next ten years

(Bureau of Labor Statistics, 2018).

According to the US Bureau of Labor Statistics (2018), among the twenty occupations with the highest projected numeric change in employment are accounting, marketing research and management analysts. Other than nursing, no other occupations directly linked to Oregon Tech degree programs are listed. Among the twenty fastest growing occupations are information security analysts (cyber), which is projected to grow at a rate of 28% (Bureau of Labor Statistics, 2018). This information indicates that the degree programs within the Business Management department have high relevance to the current and projected job market. The statewide employment outlook also shows strong growth in business fields throughout the state (Appendix B).

Comparators, Structures & Graduation Percentages

Of the universities categorized as polytechnics, the majority (19 out of 27) have a separate College/School of Business (Figure 1). Additionally, all the other Oregon state universities have a separate Business College. This distinction helps to clearly identify and brand business programs to prospective students.

Business graduates account for 8 to 16% of total degrees at other Polytechnics, while Oregon Tech only produces 5% of business graduates

(IPEDS, 2017)

According to IPEDs graduation statistics, while Business Management programs at Oregon Tech account for 5% of graduates, other polytechnic institutions graduate upwards of eight to 16% of business degrees/to total graduates at their institutions. Since other polytechnics that have a College/School of Business have a higher percentage of graduates, this would indicate that the business programs at Oregon Tech have potential for significant growth if they receive more focus.

University Comparator Groups Excluding Oregon Tech	College/School of Business	Department of Business	Included College/School Engineering	Included in Other Area
Oregon	5	0	0	1
Polytechnic	19	3	1	4
Total	24	3	1	5

Figure 1: Comparators

Graduation Success

Graduates earning business degrees from Oregon Tech are successful.

- Health Care Management graduates earn average starting salaries of \$52,000 working as Contract Specialists, Referral Coordinators, Outreach Coordinators, and Quality Management Specialists.
- Health Informatics' 2017 placement rate was 96% with an average starting salary of \$56,000. The program maintains active internships with Klamath Health Partnership, Klamath Basin Behavioral Health, Asante, Kaiser, Cambia, and Sky Lakes Medical Center
- Information Technology's 2017 placement rate was 90% with an average starting salary of \$55,000.
- Entrepreneurship/Small Business Management's 2017 placement rate was 100% with an average starting salary of \$41,000.
- Operations Management's 2017 placement rate was also 100% with an average starting salary of \$63,000, and is one of the majors with the highest starting salaries at Oregon Tech.

**The average starting
salary for Oregon
Tech's Operations
Management is
\$63,000**

(Oregon Tech's Graduation Success, 2017)

Business Management Department

Department Summary

As of summer 2018, the department offers eight degree programs: (1) Health Care Management (three degree options), (2) Business - Management, (3) Business -

Accounting, (4) Business – Marketing, (5) Information Technology, (6) Health Informatics, (7) Operations Management and (8) Technology and Management.

**The new
Cybersecurity
degree is expected to
role out in the
fall of 2019**

(Subject to internal and external approvals)

All of the degrees are offered in Klamath, Portland-Metro and Online with the exception of the three Business degrees in Accounting, Management, and Marketing. Three minors are offered: (1) Business and (2) Health Informatics (3) International Business

A proposal for a Bachelor's degree in Cybersecurity has been developed with the goal to offer it in all locations between 2019 and 2021.

The degrees are fully accredited by the International Accreditation Council for Business Education (IACBE).

History

In support of Oregon Tech's mission to provide hands-on education with real-world application, the Business Management Department's history parallels that of industry and advances in technology.

The Business Management Department's more traditional degrees (Accounting, Small Business, Management, and Marketing) were developed in the late **1990s**. Since then, the degrees have evolved to reflect changing industry trends. In particular, the marketing degree includes digital marketing courses and various marketing-specific areas of interest that highlight industry needs such as search engine optimization (SEO), search engine marketing (SEM), graphic design utilizing Adobe Suite, and optimizing Social Media, and other technology like GIS.

In **1999-2000**, Oregon Tech added the Information Technology degree to its curriculum. This degree started out as an interdepartmental degree between the Management Department and the Computer Systems Engineering Technology (CSET) Department to provide application development education for businesses that needed more of this kind of skill. In 2004, the degree was fully incorporated into the Business Management Department. Health Informatics was added in the fall of 2005.

In **2009-2010** the Department revised its Operations Management program. This program has undergone several substantive revisions over the years, including receiving ABET accreditation in the mid-1990s, dropping the ABET accreditation in 2002-2003 in response to student and employer feedback, and modernizing the

curriculum in 2009-2010 to incorporate Lean Management and Six Sigma concepts. Today, Operations Management students have the opportunity to earn green belt certification in Six Sigma as graduates of this program. According to internal graduate surveys, the Operations Management graduates receive the highest paid jobs of Oregon Tech graduates.

The Business Management Department began offering the Bachelor of Applied Science in Technology and Management (BAS) in **2011**. This degree program, along with the Health Care Management degree, new to the department fall **2013**, is designed for students with previous educational and professional experience in health care and career and technical education.

Students can earn Six Sigma Green Belt Certification, a highly sought after credential in industry

In **2000**, Business Management Department faculty led campus-wide efforts to develop and deliver high-quality online courses. In the past decade, online offerings within the department have grown considerably. The Information Technology degree was the university's first degree program to be offered fully online in 2005.

Today, approximately 70 percent of the Business Management Department's courses are offered online and over 90 percent of faculty have developed and delivered online courses. Most degree programs are available in all three locations, Klamath Falls, Portland-Metro and through Distance Education.



The Future

The plans for the future include exploring expanding business offerings in Portland-Metro and online, as well as the exploration of Master's programs in Business Administration, Engineering Management and Healthcare Administration.

Creating a BUSINESS Presence at Oregon Tech

In order to support the College of Business, a more significant "Business Presence" needs to be created to attract and retain students to the program. Owens Hall on the Klamath Campus, located alongside the "Engineering mall" leading down to the future CEET

building, is an optimal location to create an enhanced business presence on the Klamath Campus. This centralized location on campus, also symbolizes the connections business has to all other programs. Owens Hall is currently a popular classroom building utilized by Business and other majors so it receives a great deal of student traffic on a daily basis.

Business Analytics Showcase Lab

The programs seek to develop a Business Analytics Showcase Lab at the front north entrance of Owens Hall. This \$250,000 investment creates a positive return on investment in a number of ways:

- Establishing an environment that supports the business curriculum and pedagogy.
- Creating a showpiece for the campus, faculty, and alumni, and enhancing the quality and prestige of the program.
- Providing real-life simulations to keep the students engaged, enhancing the learning experience.
- Functioning as a recruitment tool to entice new applicants.



Information Technology & Cyber Security Data Labs

The equipment currently located on the Portland-Metro campus will provide the basic structure to build labs at each of the campuses to create redundancies so students in all locations will have the required access. While the Portland-Metro campus has a lab environment that attracts and retains students, the Klamath campus is planning a new updated environment to house this equipment. In addition, the computer lab in Owens, which supports the business and IT programs also needs a refresh of equipment and environment. The goal is for these two labs to be connected and have inviting glass-front entrances. The cost is still being determined.



College of Business Naming Opportunity

The naming of a College of Business is an opportunity for an individual, family or corporation to show its support for business at Oregon Tech. This investment will help grow and strengthen the College of Business' key initiatives: Provide a high quality, technology-enhanced business education; Provide a hands-on, innovative learning environment that enables and encourages student-focused learning; Commit to maintaining a climate of integrity and professionalism among all faculty, staff and students; and Practice ethical behavior in all aspects of its business educational mission. This opportunity is developed through the Alumni, Development and the University President.

Enhancement to Owens Hall

Owens Hall has begun to receive classroom renovations due to investments made by Oregon Tech as well as a grant received from Steelcase Education. More classrooms are scheduled to be renovated in the future. However, to create a more engaging environment for students there is an opportunity to enhance the halls with more modern furniture that would create inviting study spaces for students. These type of updates would create a welcoming environment that supports the College of Business. The approximate cost is \$150,000.



Bringing Business to Portland-Metro

While the Portland-Metro campus has a significant Information Technology and Cyber Security presence, it lacks a Business presence to support the programs. The plan to create a stronger presence includes repurposing one of the IT spaces into a Business and Technology Lab. Approximate cost is \$50,000.

Marketing BUSINESS at Oregon Tech

To build a stronger more unified brand, the marketing strategy will include visuals and storylines that explain the interconnections of the business programs. This will include developing a logo that visually represents the business offerings as a whole under the department.



During the summer to fall of 2018, the business websites are being redesigned with a more intentional approach. The landing page now includes more high-quality visuals. The content has been updated and optimized to drive search inquiries. Specifically, this has been designed based on best practices and key word analytics that drive search inquiries to the pages. During the fall, this work will be continued on the program pages.

Social Media campaigns have also been designed and implemented to drive prospective students, as well as engage alumni, to the website. The "Grads Land Jobs" series is an example of this effort. Starting in September of 2018, key words will be used to further drive prospective students to the department's webpages.



Dedicated Admissions/Distance Education Position

Beginning in the fall of 2018, a newly designed position will provide the department with a dedicated admissions counselor. This position reports and aligns with Strategic Enrollment Management yet collaborates closely with Management faculty to provide the opportunity to:

- Identify segmented populations for recruiting (direct from high school freshmen, transfer, continuing and re-enrolling students)
- Design tailored recruitment plans for each population segment
- Collaborate with Marketing to develop customized outreach, recruitment, and advertising/marketing activities to achieve measurable goals
- Design targeted recruitment outreach by geography and major interest based on analytics (geo-targeting, re-targeting, and social media)
- Identify high school visits and fairs that align with recruitment plans
- Design a communication plan for prospective students
- Support influencer events and outreach to build relationships with high school counselors, dual credit instructors, community college advisers, and district and community college administrative or support staff
- Support admissions outreach, including integrating and synchronizing outreach efforts with faculty
- Implement a texting program with prospective students
- Analyze potential to target non-degree seeking students (micro-credentialing) and international students

Student Ambassadors

Beginning in the Fall of 2017, the department created a Student Ambassadors program to engage current students in the marketing efforts for the programs. These students engage in a host of events both on campus and off campus.

DECA Connections

Beginning in the Fall of 2017, the department also has been more intentional in making connections with DECA Business clubs at a variety of high schools. This has lead to Oregon Tech hosting several business competitions and conferences aimed at high school students interested in business.

Funding BUSINESS at Oregon Tech

The Department is currently working on the development of a budget to fund the future College of Business. This includes the following strategies:

- Determining optimal enrollment to support needed leadership structure for College of Business
- Analyzing leadership structure and funding opportunities
- Development of a more strategic Advisory Council
- Working with the Technology Association of Oregon to develop Industry partnerships
- Analysis of ongoing equipment needs and resources to maintain quality labs to attract and retain students (In particular analysis of equipment in the CDC and how to better utilize and align to the educational mission of the institution)
- Identify grant sources that align with departmental goals.

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Appendix

Appendix A

Occupational Outlook (according to US Bureau of Labor Statistics 2018)

Occupation	Current # of Jobs	Projected 10 year growth %	Current Median Pay
Accountants	1,397,700	10%	\$69,300
Management Analysis	806,400	15%	\$82,400
Administrative Business Manager	281,700	12%	\$94,000
Marketing Analyst	595,400	23%	\$62,400
Healthcare Managers	352,200	20%	\$98,000
Operations Managers	170,600	even	\$100,000
Network & Computer System Administrators	391,300	6%	\$81,000
Database Administrators	119,500	11%	\$87,200
Information Security Analysts (cyber)	100,000	28%	\$95,510
Computer Programmers	294,900	-7%	\$82,200
Computer Hardware Engineers	73,600	5%	\$115,000
Civil Engineers	303,500	11%	\$84,700
Electrical Engineers	324,600	7%	\$97,000
Mechanical Engineers	288,800	9%	\$85,000
Environmental Engineers	53,800	8%	\$86,000
Dental Hygienists	207,900	20%	\$74,000
Medical Imaging Technologists	335,700	13%	\$51,777

Appendix B: Statewide Employment Outlook

Field	Annual Job Openings / Average Growth Rate (2014-2024)							
	Average Annual Salary							
	Oregon		Portland		Rogue Valley		S. Central	
Medical and Health Services Managers	169	17%	73	14%	11	13%	3	15%
	\$112,400		\$126,500		\$110,300		\$89,900	
Computer Systems Analysts	210	28%	143	28%			0	28%
	\$87,000		\$90,400				\$76,500	
Accountants and Auditors	607	21%	303	20%	24	15%	5	8%
	\$66,600		\$68,200		\$62,000		\$52,700	
Market Research and Marketing Specialists	204	30%	138	33%	5	20%		
	\$66,000		\$70,600		\$52,200		\$42,400	
Graphic Designers	132	13%	94	21%	5	3%		
	\$50,500		\$53,800		\$39,500			
General and Operations Managers	1121	15%	521	16%	57	9%	9	0.3%
	\$102,200		\$116,200		\$83,700		\$90,200	
Industrial Production Managers	107	12%	48	9%	5	7%	1	3%
	\$91,700		\$95,900		\$85,600		\$86,700	
Supervisors and Managers of Office and Admin Support Workers	407	13%	183	14%	18	5%		
	\$54,000		\$57,700		\$49,500		\$46,600	
Computer and Information System Managers	160	23%	108	26%	3	19%	0	5%
	\$123,200		\$131,700		\$95,200		\$78,100	
Business Operations Specialists	332	12%	189	13%	9	6%	2	1%
	\$68,300		\$73,600		\$56,300		\$56,700	

Summer Creativity Grant Final Report
**An Algorithm to Implement the Datum-based Model for Practicing Geometric
Dimensioning & Tolerancing**

Wangping Sun (PI)
Yanqing Gao (Co-PI)

1. Project Summary

Geometric Dimensioning and Tolerancing (GD&T) is a critical part in manufacturing industry. So far, the GD&T process can only be accomplished manually with the help of computer-aided tools, such as AutoCAD, SolidWorks, CATIA, etc. The proposers of this proposal have been doing research to achieve full automation of the GD&T practices. The research has achieved some preliminary success. A paper “A Datum-based Model for Practicing Geometric Dimensioning & Tolerancing” authored by Wangping Sun and Yanqing Gao has been under review by the Journal of Engineering Technology since March 2018.

As the continuation of the research in GD&T, the proposed project is to develop and publish an algorithm that implements the datum-based GD&T model. It will be the second step of achieving fully-automatic GD&T specification process in mechanical and manufacturing design. When the project is finished, a research paper will be written and submitted.

If the algorithm can successfully be developed, the proposers will write a bigger grant and communicate with the computer-aided design (CAD) software companies to seek industry sponsorship and collaboration to implement the renovation in the GD&T practices through CAD software.

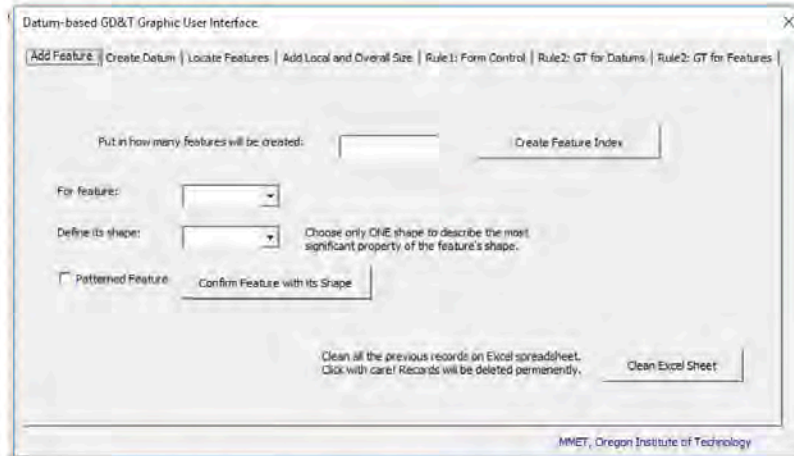
2. Project Results and Analysis

The Summer Creativity Grant project has the following deliverables available:

- 1) A paper entitled “An Algorithm to Implement the Datum-based Model for Practicing Geometric Dimensioning & Tolerancing” has been drafted and being revised and improved. The algorithm will be implemented in teaching from fall 2018. The paper has been submitted to the 47th SME North American Manufacturing Research Conference to be held in June 2019. The paper’s abstract is as follows:

“Geometric Dimensioning and Tolerancing (GD&T) is a critical part in mechanical and manufacturing design. So far, the GD&T process can only be accomplished manually with limited help from computer-aided tools. The whole process is tedious. To automate the GD&T process has many positive impacts on boosting both the effectiveness of student learning and competitiveness of the manufacturing industry. A datum-based model for practicing GD&T has been developed. In this paper, the authors will introduce an algorithm to implement the datum-based GD&T model. They will also introduce a VBA (Visual Basic Applications) software tool that computerizes the execution of the algorithm.”

- 2) A VBA GD&T software has been developed with the paper. The software has about 800 lines of code. The user interface of the software is attached below. Through this interface, students will interact with the developed algorithm and can complete the tolerancing process semi-automatically. Student's feedback will also be collected from the teaching in fall 2018 and will be consolidated into the paper. Video tutorials on how to use the VBA tool have also been produced and ready to use.



- 3) A GD&T problem bank has been created with about 30 questions. Starting from fall 2018, the PI and Co-PI will keep enriching the bank with more questions through students' projects when they teach MFG 314 Geometric Dimensioning and Tolerancing.

3. Outcomes, Conclusions and Next Steps

In summary, the promised deliverables of the Summer Creativity Project have all been accomplished.

The future research plan goes as follows:

- 1) The PI and Co-PI have reviewed all major commercial CAD software packages. None of them provides the functionality that the proposers require of. Currently, they are evaluating a software package by <https://www.inspectionxpert.com/> for their future research.
- 2) The PI and Co-PI have drafted a proposal abstract and submitted to Dr. Mostafa Saber for possible funding support from OMIC. Their intention is to set up a training seminar at OMIC. The proposal abstract is attached below:

OMIC R&D TECHNOLOGY BOARD Conceptual Abstract

Title: Building a Training Model to Disseminate Latest Research Achievements among OMIC Members through a Short Hands-on Seminar

Date: September 21, 2018

Submitters: Dr. Wangping Sun (wangping.sun@oit.edu), Oregon Institute of Technology

Supporters: Dr. Yanqing Gao (yanqing.gao@oit.edu), Oregon Institute of Technology

Project Type: A Joint General Project

Fit with RoadMap: The proposed project fits the OMIC Road Map in multiple aspects. It belongs to the areas of manufacturing “automation and optimization”. The training modality to be built will benefit the “industrial competitive advantage and academic growth” by binding GD&T hands-on practice and student learning together. It will enable the manufacturing novices (e.g. fresh college graduates) to address design issues of the industry with “immediate manufacturing responses”. The GD&T knowledge to be conveyed is applicable to both “additive and subtractive manufacturing processes”, which are the two major manufacturing fields advocated by OMIC. The implementation proposed by the project is a “cost-efficient R&D activity”, in which only AutoCAD or SolidWorks is needed.

Project Description:

GD&T is a critical part in mechanical and manufacturing product and process design. So far, the GD&T process can only be manually and tediously accomplished with limited help from computer-aided drafting tools. To automate the GD&T process by using Computer-aided Tolerancing (CAT) approach has been the interest of both industry and academia. In the proposed project, the proposers will disseminate their latest research achievements in CAT by providing a short-training seminar. They will invite attendees (novices with limited experience or knowledge in GD&T) to the seminar. Through the training, the proposers will form a training modality that is specifically suitable for OMIC companies. This training modality will be beneficial for disseminating the research achievements of all other areas among OMIC members.

Project Outcomes:

The proposed project will substantiate a new approach to practice GD&T. With the GD&T CAT tool that the proposers provide, the GD&T process will become less labor-intensive and more user-friendly. During the project, the proposers will collect data to study the learning behavior and effectiveness of the training. After the project is completed, the proposers will write a research paper on engineering education to report their findings. As far as broader impact is concerned, this project will not only be the contribution to engineering education, but also will provide a platform for “inspiring and educating the next generation’s manufacturing workforce”. This project will seek how to utilize the teaching niches of Oregon Tech and its latest research achievements to contribute more to the OMIC initiatives. It is hoped that the training modality to be built by this project can be transplanted to other manufacturing areas and will potentially generate a big impact on the workforce training of all manufacturing industry in Oregon.

Project Duration: the project will be completed one academic term.

Development of a BS in Data Science

Kenneth Davis, Jeff Dickson, Joseph Reid and Rosanna Overholser

Summer Creativity Grant Final Report

Sept. 18, 2018

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Overview

Industry's need

Part of Oregon Tech's mission is provide educational opportunities to meet the emerging needs of industry in Oregon and to foster student success. There has been much recent job growth for data scientists, with a high projected future growth. There are currently no BS programs for data scientists in Oregon's public university system.

Many different industries now use data science, for example GIS, public health, energy industry, bioinformatics, robotics, etc. It is absolutely essential that there is a strong data science presence on campus to help keep all Oregon Tech graduates competitive.

Looking beyond industry's needs, we can see that data and algorithms are increasingly a part of everyday life. All of our graduates deserve to have a basic understanding of how their personal data is being used to create credit scores, purchase recommendations, etc.

Meeting the demand

We see the **mission** of the BS in Data Science program as:

To empower graduates to use data to gain new insights, answer questions, and support data driven decision making. The B.S. Data Science provides a strong foundation in mathematics, statistics and computer science so that evolving technology will be applied appropriately and efficiently. Graduates will be able to effectively communicate solutions and work as part of a cross disciplinary team.

The **educational objectives** of the program are as follows:

- Obtain a strong foundation in mathematics, statistics, and computer science in order to grow with technological trends.
- Understand how to collect and analyze data needed to solve problems.
- Effectively communicate solutions to relevant stakeholders.
- Have the knowledge and skills needed for immediate employment as a data scientist or acceptance into a graduate program.

In order to achieve these objectives, the program will combine existing classes from the **Computer Systems Engineering Technology**, **Applied Mathematics**, and **Management** departments with new courses specifically designed for data scientists. A key part of the program will be the **hands-on** and **cross disciplinary** experiences students will receive through the completion of junior and senior level projects.

Although the major will be hosted by the Applied Math department, students will be expected to specialize in a second field of study (for example, geomatics, environmental science, marketing, or healthcare). This specialization will be achieved by 1) either a dual major or a minor in the second area of study and 2) by the student pursuing junior and senior projects in their chosen area.

The program will initially be offered at the **Klamath Falls campus**, expanding to Wilsonville or online only after the new course content has stabilized enough to make remote delivery feasible and as market and financial analyses indicate the benefit of expansion.

Oregon Tech Board of Trustees
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4.2 Summer Grant Projects/Sabbaticals

Figure 2: Skills that appear in at least 15% of 751 job advertisements for data scientists. The most frequently requested skill was the ability to program in Python; the Applied Mathematics department currently teaches Python in Math 451 and Python will be used in the four new courses in data science that are currently being developed. Two of these new courses cover Machine Learning, the second most requested skill. Relational data bases skills such as SQL are already being taught in courses offered by both CSET and Management departments. Hadoop and Spark are two ways that some companies have chosen to handle large amounts of data; it is not clear that our students will benefit from more than just a brief introduction to them so we are currently planning to only briefly mention them in a course primarily focused on other topics.

Market Considerations

Employment Characteristics

Salaries of data scientists are typically high, with Glassdoor.com reporting a median salary of \$99,149 on July 6, 2018 for entry level workers. This number is likely higher than our graduates can expect as Glassdoor's dataset included workers with advanced degrees. We did not find an external source for the median salary of a data scientist with only a BS degree, but expect starting salaries would range from \$50,000 to \$75,000.

- Bureau of Labor Statistics expected change in employment between 2014 and 2024 is +54% growth.
- Structural Employment Gap is estimated between 140,000 and 190,000 jobs beyond the number of graduates produced for the 2016/2017 biennium.

During a one day examination of job advertisements for data scientists in July, we found 751 jobs listed in Seattle, Portland, Reno and San Francisco. Throughout the summer, the number of postings in Portland ranged between 20 and 30.

Existing Programs

A Google Trends analysis (see figure 3 below) suggests that in the US, searches for "data science degree" are being as popular as searches for "mechanical engineering degree".

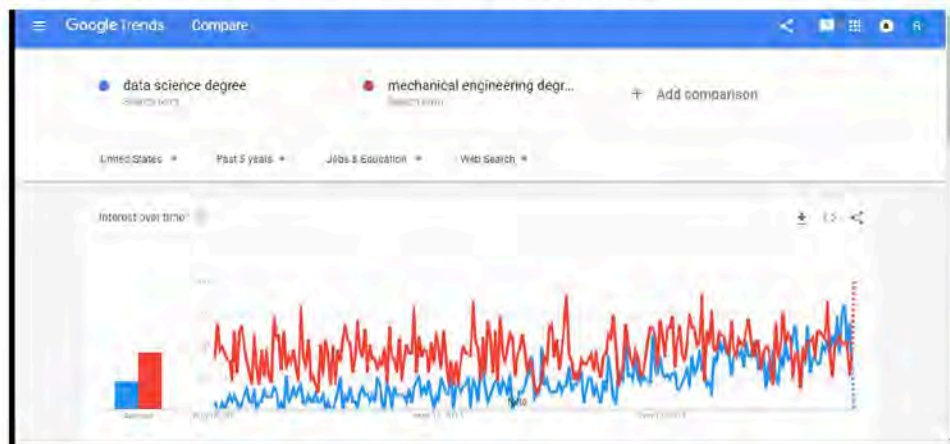


Figure 3: Google Trends analysis of the search popularity of the term "data science degree" (blue) vs. "mechanical engineering degree" (red). Notice that five years ago, there were almost no searches for data science, but within the last year the percentage of searches equals those for mechanical engineering. Note that these trends are for Google searches from the entire US, not just Oregon.

In course of our summer research, we found only 51 four year programs in data science or very closely related fields nationally and internationally combined. The closest four year programs to our region are at the University of San Francisco, UC Irvine, UC Berkeley, and BYU Idaho. There are two graduate degrees related to data science currently offered in Oregon: a Masters in Data Analytics at Oregon State and a focus at OHSU CSEE Masters.

- UC Berkeley saw explosive growth at the undergraduate level (from 300 to >1000 students in one year)
- University of SF is a campus of 6745 and had an enrolment of 85 students in the 2017 to 2018 cohort. (Approx 5% of total cohort)

Expectations for Oregon Tech

Data science programs at other universities appear to average between 2% and 4% of total enrollment in size, translating to approximately 40-80 students on the Klamath Falls campus. With the addition of dual major students, this could grow to 60-120 students in a four year period (cohorts of 15 to 30 students, sufficient to justify courses).

We expect that high school students with an interest in mathematics and computer programming will be drawn to our program. Nontraditional students who see a high demand for and high salaries of data scientists may also be attracted to the program.

Risk analysis

Existing Programs

In contrast to many existing programs, Oregon Tech's polytechnic focus provides the opportunity to complement the data science program with a wide variety of applied expertise. Portland State University is currently developing a four year program in data science. While PSU has the advantage of being near large companies in the Portland area, we have the advantage of small student to faculty ratios. We hope to leverage these ratios into training students who are employment ready. While our Klamath Falls campus is not near many employment opportunities, we believe our interdepartmental approach has the potential to leverage existing contacts and hiring pipelines.

Faculty

Competition for hiring competent data scientists is intense. Faculty with expertise in this area are offered excellent opportunities in industry, and institutional support must be strong to attract and retain qualified personnel.

Workload in these courses is high for both faculty and students as each application requires the ability to create a specialized approach.

Infrastructure

Curriculum

In designing our curriculum, we have striven to make use of existing courses as much as possible, only designing new courses when we found that the necessary topics were not already taught at Oregon Tech.

Through existing courses, students will receive

- rigorous training in foundational computer science principles (at least 4 CSET courses),
- necessary mathematical and statistical foundations (at least 10 MATH or STAT courses),

- practical computing skills, project management, and the ability to assess client needs (at least 3 MIS courses).

We envision 4 new courses being created by the Applied Math department to address specific topics needed by data scientists that are currently missing from existing classes. New courses will also need to be created to organize the junior and senior level projects.

Of the four new courses we are designing, we believe that two of them (Statistical Machine Learning I & II) will also be used as upper-division math electives by other majors. This expectation is supported by the experimental offering of Math 407 Machine Learning in the Spring of 2018. We saw 16 students sign up for this course and 11 complete it for credit towards their major.

Several programs currently under development (MS in applied mathematics, MS in geomatics, BS in robotics) have expressed an interest in including Statistical Machine Learning I and II as required courses.

Interdisciplinary interactions

Expertise in data science is a useful adjunct for almost all existing degree programs, and the program is designed to cross inter-disciplinary boundaries by requiring specialization in a second field. The closest fields are CSET and applied math, but data science is a distinct discipline.

Growth and viability

Ramp up should be dictated by student interest. By making careful use of existing resources and areas of expertise, as outlined above, ramp-up can occur in an organic fashion as student demand grows. Because the topic places strong demands on instructors, class size should be limited.

Vitality and sustainability can be measured by student enrollment, graduation, and job placement.

Retention

This program may help with campus wide retention as it may act as safety net for students who start in CSET or IT but find aren't interested in current CSET or IT focus areas.

Budget Analysis

We are still working out a budget for the program and plan to complete it by the end of October, 2018 as part of our proposal for a new degree program for CPC.

So far, we have met with Todd Breedlove of CSET and John Ritter of GIS to discuss what resources might be needed by their departments. We have also met with Erika Veth to discuss marketing needs and Barbara Neel to discuss which grants we can apply for.

Currently we expect that another faculty member might be needed to cover the additional workload. We are in discussion with the CSET department to determine what resources might be needed to train students in high performance computing, and are watching MIS's exploration of cloud computing accounts.

A critical part of the program's success will be the faculty members' ability to remain up to date with current technology and techniques. To this end, we will need to ensure sufficient funds for the faculty members to attend conferences and workshops and to connect with industry partners.

Marketing/recruiting/enrollment efforts

We plan to work closely with Erika Veth and the marketing department with regard to attracting new students. Since data science both is a relatively new job title and degree program our marketing efforts may need to educate potential customers as to what a data scientist is.

Students success through professional practice

Our students will practice being data scientists through junior and senior level project courses.

In one of the required projects, we envision connecting our students to local industry by soliciting local businesses for projects that our students could work on. Since these businesses probably don't currently employ data scientists, a student's work on a project would be overseen by a faculty member. For example, predicting attendance at the Klamath Falls Farmers' Market on a given Saturday. The student could work a few hours a week to collect data and build a forecast model, meeting with the faculty member through the project course.

Since "Data Scientist" is a relatively recent job category, we do not anticipate that companies will already have internships set up for them. Instead, we will need to reach out to current data scientists in the industry, and ask if we can help design an internship program. We could start with Nike and Intel.

October 4, 2018

Executive Summary – BS in Data Science at Oregon Tech

By Joseph Reid and Rosanna Overholser

Today, information is being produced and collected at an overwhelming pace, much faster than we are currently capable of analyzing it. The field of data science recently emerged in response to this deluge of "big data." Data scientists must have strong mathematical, statistical, and computing skills coupled with the ability to communicate well.

The practice of data science is one of the fastest growing occupations in the US and no public university in Oregon presently offers a bachelor degree in data science. Due to its status as a polytechnic institution, Oregon Tech offers the perfect environment for nurturing data scientists who are able produce data-driven solutions while working in an interdisciplinary team.

Students seeking a Bachelor of Science degree in Data Science at Oregon Tech will take their major courses in the Applied Math, Computer Systems Engineering Technology, Management and Geomatics departments. In a capstone project, each student will develop a data driven solution for an outside group, such as a local business or national organization.

After graduation, students will be ready for immediate employment as data scientists or for advanced coursework. Graduates may choose to continue their education in data science through, for example, OSU's Master's in Data Analytics program or OHSU's Master's in Computer Science and Electrical Engineering program.

Data is the foundation of tomorrow's industry. Not only will a data science program help fill a growing need in technical expertise, but the presence of the program at Oregon Tech will facilitate the successful evolution of existing programs in fields such as engineering, geomatics, business and healthcare.

ESTABLISHING AN APIARY AT OREGON TECH

Terri Torres and Christy VanRooyen

Project Summary

The purpose of this project was to fund the establishment of a honey bee apiary at Oregon Tech with two honey bee hives located in the campus arboretum. These hives will be utilized to promote awareness about global pollinator decline. The hives also present a unique opportunity for undergraduate research projects related to pollinators.

Data collected about the hives will be integrated into various data analysis classes on campus including ENV 226 and specific sections of MATH 361 and 362.

This project was led by Terri Torres and Christy VanRooyen, both of whom have extensive experience working with bees. Terri is a master bee keeper and is a member of the Klamath Bee Keepers Association. Christy is a former employee of the Bee Girl Organization a small nonprofit out of Ashland, OR with the aim of promoting bee conservation and research.

Pollinator decline is of ecological concern because 85% of flowering plants globally rely on pollinators for reproduction, making pollinators keystone species in terrestrial environments (Xerces 2017). The US Department of Agriculture Agricultural Research Service (USDA-ARS) credits pollinators for one of every three bites of food people eat (Collen et al. 2012). The financial impact of the services pollinators provide is valued at approximately \$180 billion US dollars per year (Collen et al. 2012). Globally, there are 152 species of Hymenoptera listed on the International Union for Conservation of Nature Red List, most with the status of threatened (IUCN 2017).

Project outcomes included:

- Colonizing 2 hives in the campus arboretum.



Figure 1: Oregon Tech's *Apis mellifera* ssp. hives.

- Purchasing the necessary equipment including PPE to make hive maintenance possible.
- Developing a safety protocol for hive management on campus.
- Engaging student interest in pollinator conservation and beekeeping practices.
- Providing unique opportunities for student research projects.
- Beginning the process of earning national recognition as a Bee Campus through Bee City USA.

Project Results and Analysis



Figure 2: Hive activity on September 26th, 2018.

We are happy to report that the bee colonies are in place in the campus arboretum and have shown continued growth over the summer. We currently estimate the total number of bees housed in the hives between 5,000 and 8,000. Weight measurements, which began in July, indicate the sustained growth of the hive. Note the dip in September is due to honey harvest in preparation of hive winterization. An estimated two pints was harvested. It should be noted that there usually

isn't a large honey harvest the first year since the bees are required to lay the foundation for all of their frames.

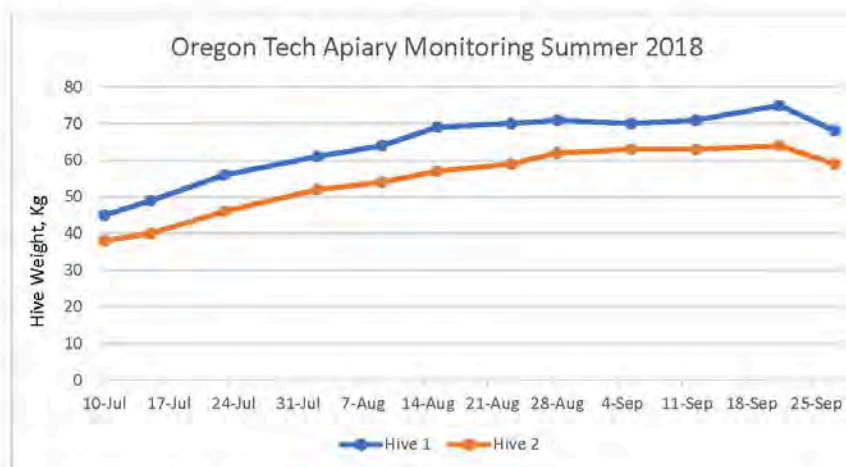


Figure 3: Hive Weight from July 10th, 2018 to September 25th, 2018. Hive weights were determined using a Fischer Nectar Detector. A honey harvest took place on September 21st, in preparation for hive winterization.

Guidelines for safe beekeeping at Oregon Tech were established (see Appendix I). These practices align with the standards established by the Apiaries and Bees for Communities organization. The safety protocol includes posting notifications about the presence of hives. Part of our funds were used to purchase safety signs to post both on the outer fence of the arboretum and near the hives. Figure 4 shows the signs in situ.

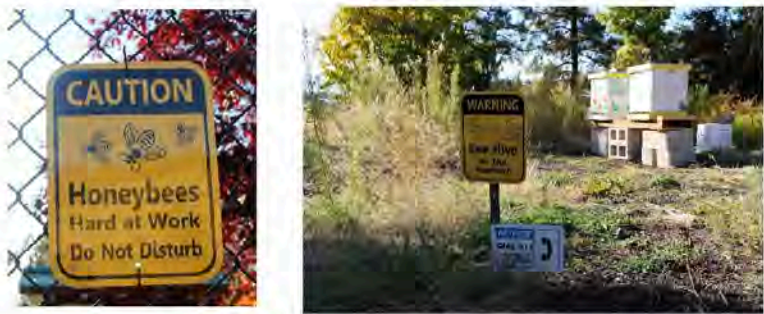


Figure 4: Caution signs alerting visitors to the presence of the hives.

In addition to hive weight, we have begun monitoring instances of floral resources use. The following flowers were the most commonly utilized floral resources within 100 meters of the hives over the summer determined by visual observation of *A. mellifera* collecting pollen or or feeding on nectar.

Table 1: The most commonly utilized floral resources within 100 meters of the Oregon Tech *Apis mellifera* hives.

Floral Data		
	Common Name	Scientific name
June	Mountain Ash	<i>Sorbus aucuparia</i>
	Prariefire Crabapple	<i>Malus sp.</i>
	Rhododendron	<i>Rhododendron sp.</i>
	English Lavender	<i>Lavandula angustifolia</i>
	Lupine	<i>Lupinus lepidus</i>
	Applegate's paintbrush	<i>Castilleja applegatei</i>
July	Narrowleaf Milkweed	<i>Asclepias fascicularis</i>
	Showy Milkweed	<i>Asclepias speciosa</i>
	Yarrow	<i>Achillea millefolium</i>
	Common Sunflower	<i>Helianthus annuus</i>
	Blue elderberry	<i>Sambucus mexicana</i>
	Common Mallow	<i>Malva neglecta</i>
	English Lavender	<i>Lavandula angustifolia</i>

	Applegate's paintbrush	<i>Castilleja applegatei</i>
	Lupine	<i>Lupinus lepidus</i>
August	Big Sage	<i>Artemisia tridentata</i>
	Rabbitbrush	<i>Chrysothamnus nauseosus</i>
	White brodiaea	<i>Triteleia hyacinthina</i>
	Common Sunflower	<i>Helianthus annuus</i>
	Fireweed	<i>Epilobium angustifolium</i>
September	Rabbitbrush	<i>Chrysothamnus nauseosus</i>
	Common Sunflower	<i>Helianthus annuus</i>

Student interest in pollinator conservation and beekeeping practices has already increased due to our educational outreach efforts. A new Beekeeping Student Club was established this fall with Terri Torres acting as the club advisor. The students are already involved in the care of the bees and have shown great interest in the study of bees as well as working on future projects.



Figure 5: Here a student examines a plate looking for varoa mites.



Figure 6: Winterizing the hives in the Oregon Tech Apiary.

While at a workshop on bee taxonomy, Christy participated in the recording of the podcast PolliNation which was publicly released on July 30th. Thousands of people across the U.S. heard the name Oregon Tech while learning more about native bees from Sam Droege, a bee expert with the USGS. You can find the podcast here:

<http://blogs.oregonstate.edu/pollinationpodcast/2018/07/30/sam-droege/>

We participated in the Oregon Tech Girls Got Stem camp in August, where we led a session on bees. Participants had the opportunity to hear a short lesson on bees, view native bee specimens under a microscope, and to roll beeswax pillar candles. We reached over 20 female students between the ages of 15-18 years through this program.

One of the deliverables when we proposed this project was to provide student opportunities for research. We have identified four potential project areas where students could be involved.

1. In partnership with Oregon State University and the Oregon Department of Agriculture, we have been invited to contribute to the Oregon Bee Atlas. This project aims to identify the native bees of Oregon. Students would get to participate in collecting bee specimens and then preserving them to be included in the entomological museum collection housed at Oregon State. Students would create records for their specimens and could potentially have their name associated with the discovery of new species in Oregon. The Bee Atlas project has already donated pinning and collection supplies to us so that we can sample monthly from May to September of 2019.

2. Using hive weight data and floral blooming patterns we can track phenological trends over time. These trends could be further substantiated though collecting pollen samples from a hive and running DNA analysis to determine which floral resources are the most valuable to our honey bees. We are currently examining the possibility of doing RNA extraction and then sending off samples for sequencing as we do not have a sequencer on campus.
3. We would like OIT to become a data repository for beekeeping information in Klamath County. This winter, we plan to distribute a survey to members of the Klamath Bee Keepers Association collecting info about where people keep hives, hive success, and mite treatments. This survey will be incorporated into GIS so then we can begin to query geospatial relationships in the data.
4. We are seeking help from the engineering departments to develop instrumentation which could continuously monitor hive weight, internal temperature, and humidity.

On Sept. 25th, we presented these project ideas at the Natural Science department's Student Research Exploratory Meeting. Eight students volunteered to participate in our pollinator research. We hope to develop a spring term course which would offer credit to students who are actively involved in our studies.

Results and Next Steps

The establishment of an apiary project has been a great success. Our bees are doing well on campus and we have already accomplished many of our objectives. We continue to partner with the local beekeeping community to promote bee education and conservation. Our inclusion in the Bee Atlas project provides exciting opportunities for recognition for our students. The bee club on campus will allow students to make a significant contribution to our pollinators through planting projects and community outreach.

We are still working on securing a Bee Campus designation. The next step toward this end requires that the university have a committee devoted to pollinator success. We may be able to do this through our already established Sustainability Committee. We are currently awaiting details from Bee City USA on the specific requirements they expect.

With our small grant of \$ 2,258.86 from RFP we were able to place the hives. However, additional funding will be needed to make our research plans a reality. Now that we have

students on board, we are researching other grant opportunities for monitoring equipment and student stipends.

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Appendix A

Guidelines for Safe Beekeeping at Oregon Tech, 2018

This document, modified for Oregon Tech, is based off 2013 guidelines created by the Calgary and District Beekeepers Association that were originally endorsed by Apiaries and Bees for Communities. This is not an instructional text, and anyone interested in beekeeping is strongly urged to get involved with local beekeeping groups to take advantage of courses offered through them. For more information, visit the Klamath Basin Beekeepers Association Website at <http://www.klamathbeekeepers.org/>.

Keeping honey bees in an urban setting requires responsible management to ensure safety and promote goodwill with neighbors. If managed well, urban beekeeping can be an enjoyable and beneficial activity for the whole community. It is in everyone's best interest if beekeepers are sensitive to the public's safety and concerns. This document is intended to be a guideline for responsible honey bee management at Oregon Tech to serves as:

- a resource for information to reinforce community confidence in the safety of beekeeping activities
- a list of best management practices for beekeeping at Oregon Tech
- a resource for the campus community to avoid and address complaints or conflicts about beekeeping activities

Any person who keeps honey bees has the duty to ensure the maintenance of the bees. Best practices will help foster healthy bees, significantly reduce concerns from neighbors, and create a culture that appreciates all that honeybees bring to the community.

Location of Hives

Hives at Oregon Tech are located in the southwest corner of the arboretum on campus. An appropriate honeybee flight path is one of the most important considerations for urban beekeepers. There is a ten foot high fence surrounding this area offering protection both for the hives and for people visiting the site. Warning signs have been placed both on the outside gate to the fence and near the hives. The number of hives has been limited to two, the standard recommendation for hives in urban areas.

Hive Registration in Klamath Falls, OR is not legally required, however the Klamath Basin Beekeepers Association was notified of the presence of two hives at Oregon Tech.

Considerate hive management

Hive inspections and manipulations disturb the bees, and therefore will be managed for public safety. Judicious use of smoke will be utilized to help calm the bees. Hive inspections will be scheduled when:

- Field bees are out foraging
- The hive is not under stress
- The hive is in direct sunlight
- Temperatures are moderate
- There are no major events on campus near the arboretum

The area around the hives will be kept clean of hive scrapings and other hive debris to minimize the likelihood of attracting other bees, wasps or other unwanted visitors. Hives will be inspected at least weekly.

Addressing Bee Stings

According to the North American Pollinator Protection Campaign (NAPPC) in their "No Fear of Stings!" brochure

*Some people may have an allergic reaction (even some who do not know they are allergic to stings). A very small proportion of the adult population (3%) and children (about 0.5%) are allergic to bee stings and are at risk of possible systemic reactions including anaphylactic shock. If someone experiences nausea, wheezing, or difficulty breathing following a sting, or if they are stung multiple times, they should seek immediate medical care. This is rare, but is an early systemic symptom of anaphylactic shock. You are more at risk of being struck by lightning (about 700 fatalities per year) than dying from a bee sting. For example, in the U.S. population, only 40 people out of 310 million people die from stings in a typical year. Many of these incidents are actually from wasp or ant stings rather than native bees or honey bees. Ground-nesting yellow jacket wasps (*Vespula* species) are defensive around their populous nests.*

To view a copy of this brochure produced by the Garden Taskforce of the North American Pollinator Protection Campaign (NAPPC), go to www.pollinator.org/brochures.htm.

Volunteers working with bees on campus will wear appropriate personal protective gear to limit risk of stings. Appropriate safety gear includes:

- Bee keeping suit fully zipped
- Gloves
- Close toed shoes

Dial 911 in the event of a sting where a person exhibits signs of an allergic reaction.

Swarming

Swarming is natural honey bee behavior which can be avoided. Swarming is not bees chasing people but rather honeybees moving to a new location. Oregon Tech will follow these simple steps to prevent swarming:

- Regular inspections for indication of swarming
- Properly timed increases in the space available to the hive
- Splitting the hive (and keeping spare equipment on hand in case you need to split).
- Avoid using swarm cells as a source of queens when splitting
- Brood chamber manipulation to make sure the queen has room to lay
- Ensuring adequate ventilation in the hive

If a swarm is seen, immediate efforts should be made to collect the swarm. Please contact Christy VanRooyen or Terri Torres in the event of a swarm.

Disease Control

A primary responsibility for beekeepers is to properly manage disease and pests to ensure hive health. All beekeepers must be able to recognize and deal with several honey bee diseases and pests, be sure to read and follow the annual guidelines published by the Provincial Apiculturist. There are many approaches to disease and pest management, and techniques are evolving quickly. Oregon Tech is committed to using organic pest control methods which limit potential hazardous chemical exposure for both the bees and beekeepers involved in apiculture.

Education

In an effort to help dispel myths about honeybees, beekeepers are encouraged to educate the public about the behaviors of honeybees. Education is a key resource in helping neighbors understand and appreciate modern urban beekeeping. By speaking openly and honestly about beekeeping and offering opportunities for others to experience beekeeping in a hands-on way, we hope to create a culture of understanding and appreciation for apiculture and our natural environment.

Contacts

Questions or concerns may be directed to Terri Torres or Christy VanRooyen, faculty advisors for campus bee keeping activities.

Terri Torres terri.torres@oit.edu office: (541) 885-1468 cell: (541) 880-8413

Christy VanRooyen christy.vanrooven@oit.edu office: (541) 885-0959 cell: (509) 895-4843

Running head: MINDFULNESS IN HIGHER EDUCATION

1

Development of a Mindfulness Curriculum at Oregon Tech

Borgen, John G.

Oregon Institute of Technology

Author Note

I would like to thank the Provost and the Provost's Office for the Summer Creativity Grant award that allowed me to travel to the Mindfulness in Education conference. I am hopeful that what I learned there will be of great benefit to Oregon Tech students, faculty, and staff going forward.

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Development of a Mindfulness Curriculum at Oregon Tech

As proposed for the Summer Creativity Grant, this project is the development of a mindfulness curriculum at Oregon Tech. The curriculum includes in-class mindfulness practice, group-based mindfulness practice sessions, and development of materials for use in mindfulness practice. The Summer Creativity Grant supported travel to the Mindfulness in Education conference at Rhinebeck, New York as well as time spent developing the mindfulness curriculum.

Project Summary

The goal of this Summer Creativity Grant included the development of a mindfulness curriculum that could be utilized in classes by Oregon Tech faculty as well as developing the ability to instruct students, faculty, and staff to utilize the curriculum on their own. To the first goal, a mindfulness curriculum consisting of short mindfulness practice exercises has been developed and is currently being piloted in two sections of PSY 201 – Introduction to Psychology. These practices are led by the instructor and direct students to focus and sustain their attention on a given stimulus. These stimuli include, but are not limited to, the student's breathing, thoughts, physiological sensations, and sounds in the environment. Students are invited to participate, but are not required to do so as part of the class (non-participating students sit quietly and engage in other activities during mindfulness practice). As part of the curriculum, outlines of mindfulness practice exercises have been created with phrases and imagery that can be used in exercises.

The other goal for the grant was facilitating the ability to train Oregon Tech faculty, staff, and students to conduct mindfulness practice exercises themselves. A recurrent theme at the conference was that mindfulness initiatives that rely on people who don't practice mindfulness

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themselves are much less likely to be successful. As such, I have already begun recruitment with Oregon Tech faculty, staff, and students to participate in training to lead mindfulness practice groups. Dr. Kyle Chapman has begun his own mindfulness practice (in fact, he encouraged me to apply for the grant) and will be integrating mindfulness practice into his courses.

Project Results and Analysis

Due to the ongoing nature of this project and the long-term deliverables for Oregon Tech, it is not possible to provide data on project success. Use of a mindfulness curriculum in Oregon Tech classes should result in increased student ability to attend during class (and thus better grades), increased student retention, and increased student satisfaction with Oregon Tech. Measurement of student satisfaction will be included in course evaluations for PSY 201. Students will be encouraged to leave qualitative comments about their view of the utility of the mindfulness practice exercises in class. Based on other activities piloted in this class (e.g., gamification) it is very likely many students will submit comments related to mindfulness practice.

Ultimately, evaluation of the success of this project will require additional support from Oregon Tech. Currently, no student data is being collected for this project, and students are explicitly told they do not have to participate in mindfulness practice during class. There is currently no assessment of which students are participating, how the practice is facilitating their performance in class, and how mindfulness practice is influencing their experience at Oregon Tech. Data regarding whether students that participate in mindfulness practice are more likely to stay and obtain degrees at Oregon Tech would require informed consent and permission from the Institutional Review Board (IRB) so that these students could be tracked relative to other students. Data summarizing student attendance at outside-of-class mindfulness groups could be

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analyzed in relation to relevant data already being collected at Oregon Tech (e.g., grades, graduation, etc.).

Of note in relation to analyzing data in regard to the effectiveness of mindfulness practice at Oregon Tech is that conducting a truly randomized study is not warranted. Since mindfulness practice is likely to be helpful to students, denying students the opportunity to access the curriculum may deny them an activity they need to be successful at Oregon Tech. Further, students willing to participate in mindfulness practice may be students that, in turn, are trained to conduct mindfulness practice groups themselves. Indeed, it may be qualitative research methods that are the most illuminating regarding the utility of the mindfulness practice curriculum. I would expect Dr. Chapman to be helpful in this regard as well.

Outcomes, Conclusions, and Next Steps

Despite the ongoing nature of the analysis of the success of this project, there is a clear plan on how to proceed. As outlined above, the process of developing the ability of other Oregon Tech faculty, staff, and students to conduct their own mindfulness practice groups has begun. I've contacted Nellie Stewart and Carrie Dickson to assist with this, and connect this project with the Blue Zones Committee. It is expected that trained faculty will be able to integrate mindfulness practice exercises into their courses as early as Winter term.

The long-term plan is to continue to implement and evaluate the mindfulness practice exercises in the classroom along with the utility of the mindfulness practice groups. With IRB approval more rigorous assessment of the students' expectations and experiences with mindfulness practice can be conducted. Also, as students participate in training to conduct mindfulness practice their input regarding revisions to the curriculum will also be integrated.

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Lastly, the potential for collaborations and external funding for the mindfulness program will be explored and pursued. At the conference I explored collaborations with teachers in schools in upstate New York and Washington, D.C. It may help to form a 'Mindfulness Center' at Oregon Tech to collaborate with other institutions (e.g., the Mindfulness Awareness Research Center at UCLA; <https://www.uclahealth.org/marc/about-marc>). Additionally, external funding opportunities are available, which include the John Templeton Foundation (<https://www.templeton.org/grants>) and the Trust for Meditation Process (<https://trustformeditation.org/mindfulness/>).

Summer Creativity Grant Final Report – 2018

Project Title:	Mobile Usability Lab and Client Partnership Development		
Project Lead:	Amber Lancaster & Franny Howes	Phone:	806-789-0452 541-885-0339
Chair Approval: Dan Peterson	dan.peterson@oit.edu		amber.lancaster@oit.edu
Dean Approval: LeAnn Maupin	leann.maupin@oit.edu	Email:	franny.howes@oit.edu

Project Summary

Goals: Using the Summer Creativity Grant received, the Mobile Usability Lab project aimed to acquire usability lab technology; develop future technical communication courses with client-based projects and identify internship/externship opportunities with industry partners; and develop business and operation plans for a larger usability lab model.

Scope: We accomplished these goals by researching technology needed for industry standards in usability testing; by meeting with OIT entities to share our project vision, learn about existing client-based models, and solicit partnerships; and by meeting with professional organizations to identify prospective industry partners.

Deliverables: The Mobile Usability Lab project produced three deliverables:

- (1) Technology equipment for a mobile usability lab: a laptop, Morae usability software, and Logitech headset.
- (2) A report and assessments of visits with local prospective partners in the Klamath Falls and greater Pacific Northwest regions.
- (3) Action plans for industry partnerships.

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Project Results and Analysis

Goal #1 – Acquire Usability Lab Technology

Methods: We worked with OIT ITS to obtain an approved laptop that met OIT standards. We purchased a Dell Latitude 5590 laptop, Morae usability software, and Logitech USB Headset H340.

Challenges & Lessons Learned: The laptop we budgeted for in the grant did not meet current OIT minimum specifications; we dealt with this challenge by seeking assistance from the CIO. We were given additional assistance to meet the full cost of a better laptop than we planned for on the condition that we conduct a demonstration of Morae at a later date. We also ran into challenges using the newly implemented technology purchasing system. This was a great learning experience and we are now prepared to help other faculty navigate the purchasing process.

Outcome & Analysis: By the end of the summer, we met our first goal in acquiring a laptop, usability software, and headset that met industry standards for conducting usability tests.

The mobile usability lab will permit OIT Communication faculty to integrate a usability lab unit into their courses and physically transport it to the classroom. Students will be able to reserve the mobile lab for Communication course projects under faculty supervision.

Additionally, faculty will be able to take the mobile usability lab to other physical environments for field research. Faculty and students will be able to take the mobile usability lab to client sites to demonstrate the value of usability testing for enhancing the user experience (which in turn affects a company's bottom line; i.e., fewer troubleshooting calls, increased customer satisfaction and repeat customers, enhanced company reputation, etc.).

Next Steps: We will develop training resources for using Morae. Dr. Howes will continue to become familiar with using Morae. We will apply to grants to purchase two to three more laptops with usability software. We will seek physical space to develop a formal usability lab that emulates industry practices.

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Goal #2 – Develop Future Technical Communication Courses with Client-based Projects and Identify Internship/Externship Opportunities with Industry Partners

Methods: We developed the curriculum for the PWR 330 User Research course, modified from an existing syllabus/course.

The first course offering will be in the Winter 2019 term. We contacted/met with OIT entities to solicit client-partnerships for course projects: OIT Library, OIT Career Services, and Population Health Management. We contacted/met with external entities to solicit client-partnerships for course projects: STC (Society for Technical Communication) Puget Sound, Red Chair & 13 Creatives Marketing Firm, and Indeed.

Challenges & Lessons Learned: Not every client we imagined working with had work for us to do. We also more to learn about the requirements of Oregon Tech's insurance policy as far as it applies to student projects that involve outside clients.

Outcome and Analysis: We met our second goal and have clients lined up to work with our students for the Winter 2019 term PWR 330 User Research course. We have four confirmed clients partnering with us for the Winter 2019 term course.

- OIT Library – usability test of OIT Library website
- Klamath Falls Library – usability test of Klamath Falls Library social media and website
- STC Puget Sound – usability test of STC wiki/website
- Red Chair & 13 Creatives – usability test of Red Chair website

We have established interest from Population Health Management and Indeed on future client opportunities.

Next Steps: We will develop client-projects with these partners to identify multi-phased testing (a scope of work beyond the Winter 2019 term for on-going usability testing). We will contact again the OIT Career Services during the Fall 2018 term to solicit client-partnerships for course projects. We will contact new entities at OIT and in industry to solicit client-partnerships for course projects.

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Goal #3 – Develop Business and Operation Plans for a Larger Usability Lab Model

Methods: We met/networked with several entities (OIT and external) to learn about partnerships, business models, and other possible industry-partnership leads.

We met with Sophia Nathenson with Population Health Management to learn about its client-based model. We met with Vivian Chen with Contracts Office and Legal Liaison with Finance and Administration at OIT to learn about contract/legal agreements and insurance needs for client-based projects.

In Seattle, we met with Nathan Mead and Steve Addison at the OIT Seattle/Boeing Campus to talk about possible partnerships with industry companies they already have established partnerships. We met with Mike Potter at Lake Washington Institute of Technology to talk about possible partnerships with their faculty in user research and media design. We met with Lin Laurie and STC members of the Puget Sound chapter to talk about partnerships with STC and obtain leads on other potential industry clients. We met with UXPA (User Experience Professionals Association) members to talk about partnerships with UXPA and obtain leads on other potential industry clients.

Challenges & Lessons Learned: The external entities we imagined would be the most helpful and enthusiastic were not necessarily as ready to partner with us as we expected. However, through our travels we made excellent connections to grow the lab beyond our original expectations.

Outcome and Analysis: We met our goal of developing industry partnerships with businesses in the local Klamath Falls region and greater Pacific Northwest region and identifying business and operation plans for a larger usability lab model.

We have drafted the following business and operation plans:

- List of products/services for conducting usability testing
- Blanket IRB Protocol
- Blanket Confidentiality Agreement
- Blanket MOU Agreement

Next Steps: We will work with Vivian Chen and David Groff to develop contract agreement templates that meet OIT legal requirements. We will develop a business plan for a larger usability/research lab, identified revenue models, and marketing plan.

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Conclusions

Our Summer Creativity Grant project was successful in meeting its three goals and expected deliverables and outcomes.

Beyond the grant project, the mobile usability lab could also be leveraged for seeking additional grants to develop a larger physical usability lab on campus. We look forward to future conversations about the CEET facility and how our lab could fit into plans for that space.

Future programs could also include developing a professional Usability Certification and Continuing Education Units (CEUs) for working professionals who want to learn new industry skills.

Additionally, future programs could include usability assessments for cross-departmental projects at OIT. For example, OIT faculty/students in courses that design software, interfaces, mechanical objects/products, or written deliverables or that study human-computer interactions and behavior could partner with Communication faculty/students to integrate usability testing into their courses or research projects.

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**Final Report for Dr. Yasha Rohwer's Summer Creativity Grant.
October 1, 2018.**

1. Project Summary. Environmentalists and conservationists want to save and restore nature. And yet this often, ironically, means killing animals. For example, much island conservation and restoration involves the killing of exotic species that were introduced to the island by humans. These exotics are in the crosshairs of the conservationists because they are threatening to cause the extinction of native species, hence threatening the integrity of the ecosystem. An example of this kind of intervention is the planned poisoning of unintentionally introduced house mice on remote Gough island in the South Atlantic because the mice are threatening an endangered seabird with extinction. The poison typically used in such projects is an anticoagulant, which causes slow painful deaths by bleeding from organs and orifices. However, a new tool that could avoid such suffering is being developed. CRISPR is a technique to genetically modify organisms precisely and cheaply. Engineered mice populations would lose their fertility, dying out by failing to reproduce rather than being actively killed. CRISPR gene modification technology has the virtue of being able to eradicate exotics without the pain and suffering that is typical of existent conservation practice. However, the conservation community often frowns on technological solutions to conservation issues, seeing technology as a source of environmental degradation rather than an ecological savior.

In a world dominated by human influence, which some have dubbed the Anthropocene, conservationists are increasingly intervening in nature. CRISPR technology could even be used to modify natives to better equip these species to deal with climate change.

My proposed project is to research the ethics of implementing this new technology in conservation biology and restoration ecology. Do conservation biologist have a moral obligation to support the development of the technology and to implement it if CRISPR becomes a reliable and safe technology? What kinds of modifications are ethically permissible? Are there modifications that are ethically obligatory or ethically impermissible? Not all modifications of nature are equal and so categorical claims about all modification being morally permissible or impermissible are unlikely to be correct. Adjudicating these issues will require careful understanding of the technology and the ethical issues that arise when we consider changing wild nature forever.

I see two academic research papers coming out of this work, which I will submit to reputable peer-reviewed environmental ethics journals. The first paper will focus on the ethics of genetic modification to prevent species extinction. The second paper will focus on the modification of nature more generally and critically examine certain kinds of modification and try to identify the moral status of these modifications (E.g. whether they are permissible, impermissible, or obligatory). These papers will flow into a larger book project that I intend to begin in the near future.

The research for these papers is thematically linked to course content in several of my regular courses. It will help me modify existing courses—HUM125: Technology, Science, and Values, PHIL325: Environmental Ethics, PHIL305: Medical Ethics—by adding in new modules on CRISPR. Oregon Tech students will need to be up to speed on CRISPR to be competitive in fields from environmental science to medicine. Harvard Geneticist George Church has called the technique “the revolution that could change our world” and Walter Isaacson, writer and founder of the Aspen Institute, has called it “the most important advance of our era, one that will create astonishing opportunities combined with frightening moral challenges.” Peer reviewed journal articles on the technology are skyrocketing and an entire new journal, *The CRISPR Journal*, debuted earlier this year. Our students need to know about these developments and their attendant ethical challenges—and our tech-savvy students would love to learn about this exciting new technology. Thus this work advances the strategic mission of my department, which is to instill in students “a lifelong love of learning that will allow them to be successful in their professional, civic, and private lives once they leave Oregon Tech.”

2. Project Results and Analysis. Above is the project summary as it was written in the grant proposal. However, as I embarked on these research projects and met with Provost Kuleck about changes to the proposal, the originally planned project changed slightly in terms of the exact content of the second paper that was to be written. In the end the deliverables were met. I have written two papers that discuss the moral status of using genetic technologies in conservation biology.

The first paper argues that compassionate conservationists, practitioners of a new ethics movement in conservation biology, have a moral obligation to support CRISPR gene editing technologies. These gene-editing technologies could one day greatly reduce the individual animal suffering that so often occurs in conservation biology practice. Here is the abstract of this paper:

Abstract. A new movement in conservation biology called “compassionate conservation” questions the traditional hierarchy of moral values in conservation. Compassionate conservationists search for “win-win” solutions that allow species and populations to be saved without killing or causing excessive suffering to sentient creatures. In this paper I argue that these compassionate conservationists have a moral obligation to support the investigation and development of genetic modification technologies because of their potential to minimize suffering and eliminate killing in conservation. Furthermore, I will end the paper by suggesting that these genetic technologies can help avoid actions that could be damaging to one’s moral character.

As promised this paper has been submitted to a well respected environmental ethics journal—*Ethics, Policy & Environment*—and it is currently still under review.

Furthermore, I was able to present a draft of this paper at the annual conference of the International Society of Environmental Ethics, in Anchorage Alaska, this summer.

The second paper (coauthored with Emma Marris) focuses in on the movement I used to frame the discussion of my first paper—compassionate conservation. In this paper, my coauthor and I argue that compassionate conservationists need to answer some questions about how they would rank their values when they conflict. For example, what would a compassionate conservationist do in cases where it is not possible to both save species and not cause suffering to individuals? We argue that simple philosophical hypotheticals can help conservationists clarify what they value and why. We argue that these hypotheticals are much like idealized models in science, since they simplify cases and focus in on the ethically important features of the case. The paper is a commentary piece responding to a newly published article that defines and defends compassionate conservation. Furthermore, the paper explicitly asks compassionate conservationists how they view genetic engineering technologies for conservation purposes. This commentary paper has been submitted; however, we decided to submit it to a leading conservation biology journal—*Conservation Biology*, since the questions we pose would be more beneficial for actual practitioners of conservation biology.

Although my original grant request was not fully funded, I am pleased that I was able to write and submit two new papers of original work to top journals in both fields.

Additionally, my research on CRISPR gene editing technologies will be incorporated into 3 courses that I teach at Oregon Tech-- HUM125: Technology, Science, and Values, PHIL325: Environmental Ethics, PHIL305: Medical Ethics. I have found articles that will be suitable to undergraduates to learn about the technology. Moreover, these articles will help start discussions concerning the moral status of these technologies in class.

3. Outcomes, Conclusions, and Next Steps. As stated above, the promised deliverables of two new papers written and submitted to journals have been achieved. The next step in these projects is to wait on the reviewers of the journals to assess my papers. In the original proposal I wanted to spend some time thinking about different kinds of ways we can intervene in nature and what the moral status is of these different interventions. I plan on continuing to work on this project during this year, and start thinking about turning my work in environmental ethics into a potential book project. I plan to meet with Barbara Neal, Director of Sponsored Projects, this year to discuss external funding opportunities for a potential book project.

Gene drives, species, and compassion for individuals in conservation biology

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Keywords: CRISPR, gene drives, compassionate conservation, conservation, biodiversity, animals, species, endangered species, Gough Island, marsupials, suffering

1. Introduction.

Traditional conservation biology has focused on two goals: preserving and protecting biodiversity and ecosystem integrity (e.g. Soulé 1985, Noss 2000). When species go extinct, this reduces biodiversity and compromises integrity—hence the focus on saving endangered species. To protect endangered species, conservationists kill and inflict suffering on sentient creatures, because they believe that killing certain species (such as introduced rats on islands) is the only way to save the endangered species. Killing individuals for the good of species is standard conservation practice and conservationists by and large believe that this is a justified action. However, the practitioners of a new movement in conservation biology called “compassionate conservation” are questioning the traditional hierarchy of moral values in the field (e.g. Bekoff 2010, 2013; Ramp and Bekoff 2015; Wallach et al. 2015; Wallach et al. 2018). Compassionate conservationist search for “win-win” solutions that allow species and populations to be saved without killing or causing excessive harms to other sentient creatures.

In this paper I argue that these compassionate conservationists have a moral obligation to support the investigation and development of genetic modification technologies because of their potential to minimize suffering and eliminate killing in conservation. These genetic technologies promise win-win solutions to some conservation problems. I will examine two current conservation programs, one at the Arid Recovery Reserve in Southern Australia and the other on Gough Island in the South Atlantic. Both projects involve much killing and suffering of sentient mammals. I will examine the traditional justification given by conservation biologists for accepting this cost. I will then introduce a particular emerging genetic technology, CRISPR gene drives, and argue that this technology has the potential to stop the killing, minimize suffering,

and still promote traditional conservation values such as ecosystem integrity. Conservationists are often faced with hard moral choices and gene drive technologies, I argue, can, in some cases, help conservationists escape these kinds of epistemically difficult moral situations. I will then consider and respond to some objections to using gene drives in conservation. Finally, I will briefly argue that these genetic technologies could perhaps help us avoid damaging our moral characters—by focusing on the actions of citizen conservationists in New Zealand.

2. Traditional conservation goals entail a moral obligation to protect and prioritize species.

In a landmark paper, Michael Soulé (1985) defines the proper objective of conservation biology as “the protection and continuity of entire communities and ecosystems” (728). Hence, the two main goals seem to be to preserve and protect our planet’s current biodiversity and to protect and preserve the integrity of ecosystems—defined as a shared evolutionary history or historical continuity—a wholeness that persists through time.

These two goals are logically distinct. There exist places that are extremely biodiverse, yet fail to have ecological integrity. For example, many novel ecosystems are diverse collections of organisms that did not historically evolve together. They have high diversity but no or low integrity. Furthermore, you can have ecosystems that have integrity, but are lacking in biodiversity. Consider a desert ecosystem with relatively few species, but millennia of history.

Given these two goals it is easy to understand why conservation biologists spend so much time trying to prevent extinctions caused by humans. Soulé focuses on anthropogenic extinction rather than “natural” extinction because the latter could also involve speciation, which would make up for the loss in biodiversity.¹ If one species evolves into another, there is no net loss of kinds of organisms.² In the case of protecting and preserving biodiversity, no matter how one defines biodiversity, a loss of a species (without speciation) translates to a loss in biotic diversity (DeLong, 1996). And a loss of a species to an ecosystem necessarily disrupts the historical continuity of an evolved community and hence compromises the wholeness or integrity of the ecosystem.

For Soulé (1985), we must protect and restore the integrity of ecosystems and biodiversity because biodiversity and ecosystem integrity are good. Soulé and other conservationists and environmental ethicists claim that biodiversity is intrinsically valuable (Ghilarov 2000; Rolston 1985; Soulé 1985; Vucetich 2015) and that ecosystem integrity is intrinsically valuable (Leopold 1989; Soulé 1985).

One might think that there is no obligation to protect biodiversity (Maier 2012), and that therefore it can’t ground an obligation to save species or one might think that ecosystem integrity does not exist, and hence cannot be valuable or ground an obligation to save species (Gleason 1926). These arguments are plausible and I want to acknowledge that perhaps conservationists are wrong about the reasons we should prevent extinctions. However, even if they give the wrong reasons, I think

¹ Leopold (1989) makes a similar claim about human intervention in nature.

² Of course, many non-anthropogenic extinctions were caused by climate changes and asteroids rather than gradual evolution.

conservationists are likely correct that causing or allowing a species extinction is a moral wrong. Here is a case to motivate this general claim.

Imagine there are two people who have access to ferociously destructive space lasers. The space lasers, when shone on a particular piece of land, boils all living things' blood and causes them to explode. It is a grim tool of death, and the death involves an immense amount of suffering. Now imagine that our two people each select a different section of land to aim their lasers at. Both sections host populations of cognitively similar organisms. Call the populations of organisms Population A and Population B. All the organisms are sentient and both populations of individuals are exactly the same size, a number large enough that the population is genetically healthy and viable into the future. The only difference is that Population A is the last population of this kind of organism in the world, while Population B is just one of many of this globally common animal. Both people fire their space lasers, killing all individuals in their section of land, just for fun.

Clearly both of these people performed a morally wrong action. However, they do not seem equally wrong. One action seems more morally reprehensible than the other. However, each causes the same amount of suffering and death. The only difference between the cases is that one led to the elimination of a species and the other did not even threaten to cause an extinction. If I am correct to think that the action that caused the extinction is worse, then that motivates the idea that species extinction is a wrong.

Soulé (1985) clearly thinks extinction is a great wrong, but at one point in his paper he considers whether a conservation biologist should be concerned with the welfare of individual organisms. He states "It may seem logical to extend the aversion of anthropogenic extinction of populations to the suffering and untimely deaths of individuals because populations are composed of individuals". However, he immediately rejects this notion. For him, saving species is a much greater good, one that can justify causing suffering to individual animals. For example, in systems where exotic predators have been introduced, conservationists often cull or eradicate those predators to try to conserve the native fauna that they are preying upon (Jones et al. 2016). Furthermore, conservationists capture and breed the last individuals of a species and consider the suffering of those individuals justified. Indeed, if we do have duties to prevent species from going extinct, then these will often clash with plausible duties to not kill or excessively harm sentient creatures (Sagoff 1984).

3. Two current conservation projects that prioritize species.

Soulé's paper and ideas have been very influential in the conservation world. And the idea that species extinction is a great wrong, the prevention of which justifies the killing and harming of sentient animals is still alive and well today. In this section I discuss two conservation projects that are nice exemplars of actions taken with Soulé's justification in mind.

3.1 Saving endangered marsupials. The first case is a early-stage project at the Arid Recovery Reserve in Southern Australia. This project aims to try to save certain Australian marsupial species that are threatened with extinction by introduced exotic predators—especially introduced red foxes and feral cats. These Australian marsupials lack appropriate behavioral response to deal with these novel predators, exhibiting what

conservationists call ‘prey naïveté’ (Davis 2009, Mosebey et. al. 2016). Because of this naïveté, most mainland individuals of the species now live in fenced enclosures. In this protected environment the animals reproduce beyond the carrying capacity of the enclosure, which allows (but also necessitates) attempts at reintroducing certain individuals of the species to the wild. However, these kinds of reintroductions have not been very successful (e.g. Winnard & Coulson, 2008). The marsupials released in the wild become easy pickings. Certain conservation projects have tried to teach these threatened marsupials to respond appropriately to the predators—using conditioning, predator models, predator proxies, among other strategies.³ Unfortunately, the lessons have not been successful. And so a new bold plan is moving forward.

The new plan is to harness the power of natural selection to try to select away the naïveté of these animals by releasing small numbers of the problematic predators into enclosures. As the researchers on the project write, “by exposing reintroduced prey to carefully controlled levels of alien predators, in situ predation could enhance reintroduction success by facilitating acquisition of learned antipredator responses and through natural selection for appropriate antipredator traits.” (Mosebey et al. 2016). This project will necessarily result in the death of many individuals—selection is a heartless process. The conservationists proposing this new approach to dealing with prey naïveté are aware of the costs; however, they think it is ethically justified. Echoes of Soulé are to be found in their justification:

“our primary goal as conservation biologists and ecologists is to help recover populations and restore ecosystems...if in situ predation improves the antipredator responses of endangered prey, and populations are ultimately recovered, the individual suffering imposed on individual prey which might be killed while in an enclosure with a captive predator is outweighed by the benefits of recovering the population...” (Mosebey et al. 2016, 6).

3.2 Saving the Seabirds of Gough Island. Another example of privileging species over individual welfare comes from Gough Island—a small rugged island in the middle of the South Atlantic. The island is the breeding location of many seabirds including the nearly the entire population of the endangered Tristan albatross. One of the biggest threats to these birds are mice that are thought to have been unintentionally introduced by seal-hunters. These mice are literally eating the chicks to death while the evolutionarily unprepared adult birds watch helplessly (Davies et al. 2015). The plan to save these seabird species is modeled on a successful rat eradication on South Georgia Island (Marris 2018). It starts with flying helicopters over the island to drop poison in cereal pellets all over the island, in an attempt to eradicate the mice. After some time has passed conservationists will run mouse-sniffing dogs around the island and if any mice are detected, more poison will be dropped. The anticoagulant poison used in these projects causes suffering. The mice will die slow deaths, bleeding from all of their orifices and internal organs. While this is a gruesome death, conservationists believe that this is the only possible action that will help them save the bird species that are endangered because of the mice. Faster poisons won’t work because the rodents taste a little, feel bad, and stop. These mice will avoid the bait forever, in a phenomenon rodent control experts call

³ For a summary of these projects and teaching methods employed see Rohwer (2018).

“bait shyness” (Marris, Forthcoming). Again, the idea is that species extinction is such a great wrong that it can justify killing the sentient mice in quite gruesome ways.

This project will likely be justified in a similar way to the South Georgia project, or which one lead scientist said, “We as human beings have introduced these animals into a place where they shouldn’t be. To me, on balance, the stronger moral argument is we have a duty to remove these animals” (Marris 2018).

These two projects are clearly following the justification of Soulé (1985) by focusing on saving species and positing that the goal of saving species (which is a necessary means to protecting and restoring valuable integrity and biodiversity) justifies harm to many individual organisms. However, a new movement in conservation biology has been founded which asks conservationists to rethink the priority given to species over individuals and to consider other means of conserving biodiversity and protecting the integrity of an ecosystem that don’t come at the cost of the suffering and ultimately the death of many individual sentient creatures. This movement is called “compassionate conservation” (e.g. Bekoff 2010, 2013; Ramp and Bekoff 2015; Wallach et al. 2015; Wallach et al. 2018) and it seems unlikely that devotees of this movement would endorse the two conservation interventions outlined above.

4. Compassionate Conservation: The Welfare of Individuals.

Compassionate conservationists are conservationists and don’t want to abandon the traditional goals of conservation biology as explicated by Soulé (1985). They value species and think that saving species from extinction is important; however, they think that it is also important to consider and value the welfare of individual sentient beings who are often forgotten in conservation decisions or at least assumed to have less moral weight when compared to the value of saving species. For example, Daniel Ramp and Marc Bekoff claim that “Although species welfare, with its focus on the prevention of extinction, is a vital and admirable conservation objective, the welfare of individuals and their social groups should also be considered *as important*” (2015, 5 *Italics added*). Another example of conditional endorsement of traditional conservation goals can be seen in the following quote—“humanity has a moral obligation to help restore threatened populations, but harming sentient beings is a serious matter that cannot be justified solely on the basis of noble aims.” (Wallach et. al. 2015, 1).

Compassionate conservation seeks to emphasize the value of individual sentient beings and have conservationists recognize that they have moral obligations to these individuals as well as collectives like species (Bekoff 2010, 2013). Compassionate conservationists essentially reject the normal value ordering in conservation biology, which prioritizes saving species over individual welfare (e.g. Ramp and Bekoff 2015, Wallach et al. 2015, Wallach et al. 2018). For compassionate conservationists, the ethics of conservation action are not that simple, and we always need to look for ways to save species that do not involve killing individuals.

This is a very admirable goal and it is hard to deny that if we discover a means of protecting species without harming individual sentient creatures, then that is likely the ethically correct conservation action to take. Compassionate conservationists call these kinds of actions “win-win solutions” and like to emphasize that they are possible and underused. For example, sheep dogs have been used to deter introduced red foxes from

destroying a Little Penguin population on Middle Island, Australia, with great success after a traditional poisoning and shooting campaign failed (Wallach et al. 2015, Wallach et al. 2018). Killing the red foxes didn't work on this island because the island was available for re-colonization at low tide (Wallach et al. 2015, Wallach et al. 2018).

One might think that compassionate conservationists are a type of animal liberationists (e.g. Singer 1995) since they are concerned about the misery of sentient organisms. However, this is not the case. Animal liberationists are utilitarians, concerned with maximizing interest-satisfaction and minimizing pain, however caused. If compassionate conservationists wanted to minimize the misery of sentient creatures, then logically they would need to consider removing animals from wild places, since living a wild life can entail much misery for individual creatures. Mark Sagoff (1984) makes this point when he states, "The misery of animals in nature beggars by comparison every other form of suffering in the world. Mother Nature is so cruel to her children she makes Frank Perdue look like a saint" (6). Compassionate conservationists don't want to remove animals from their environment, so it is not animal misery *per se* that they want to avoid, but rather misery caused by moral agents—misery caused by conservation biologists.

In a recent paper, leading compassionate conservationist frame their approach as a virtue ethics approach and they propose that compassion should be the guiding virtue in conservation biology (Wallach et al. 2018). Wallach et al. state "A virtuous person will carefully attend to the capacity of others to experience both joy and pain making effort not to inflict *intentional* unwarranted suffering, as a manifestation of one's compassionate character" (Wallach et al. 2018, 6 *italics added*).

While it is very admirable to highlight win-win situations and it seems undeniable that if a win-win action is feasible, conservationists have a moral obligation to choose that action, it is less clear that such solutions are always possible and even if they are possible (given that logical *possibility* is a fairly low bar) that they will be feasible. For example, in the cases discussed above concerning the endangered Australian marsupials and the endangered seabirds of Gough island it seems difficult for the compassionate conservationist to avoid making the judgment about what matters more in these particular cases since it doesn't seem currently possible to both save a species and restore ecosystem integrity without killing individual sentient creatures.⁴

In cases where one must really choose between species and individuals it is unclear what a compassionate conservationist would say or whether the movement would have a unified response. Given that it is such a young movement, compassionate conservationists and philosophers should be examining these questions⁵. Should we

⁴ Some "win-win" approaches have been informally proposed in these cases, including using birth control on the Gough Island mice or using dingoes to suppress cats and foxes around release sites for marsupials. I am unconvinced that these would be effective. The birth control approach in particular seems unworkable in the steep, difficult terrain of Gough, given that success would have to be 100%. But certainly these alternatives should be explored further.

⁵ Philosophers have wrestled with the difficulty of cases where individual interests are pitted against those of those who call for saving species. Sagoff has said Animal Liberation and conservation are irreconcilable (1984). Callicott disagrees (1988). Regan clearly privileges individuals, as subjects of a life (1983). Singer might disagree—if millions of humans would be heartbroken to see a species go extinct, some suffering might be justifiable to prevent it (1995). The fact that actual conservationists are actively wrestling with these questions is an excellent opportunity for philosophers to assist and build an interdisciplinary conversation about decisions with real-world consequences.

privilege individuals when a win-win is not possible? Or will killing sometimes be permissible to save a species? I imagine that it will depend largely on the context and the particulars of individual cases. I think this is really the most important lesson from the compassionate conservation movement. The moral status of proposed conservation actions cannot be axiomized as easily as is commonly thought. The competing obligations toward individuals and to save species place us in a tough epistemic situation. There will be no easy answers and this is perhaps why Wallach et al. (2018) claim that “to conserve compassionately also means we endure our own suffering, as moral agents faced, at times, with impossible moral choices. Where we fail to find approaches that ensure both individual wellbeing and collective protection, a mark of compassion will be to endure the harrowing sense of immense responsibility and utter powerlessness that inevitably accompanies difficult decisions with no unequivocal answers.” (15-6).

I think the two conservation case studies introduced above are illustrative of these hard decisions with “impossible moral choices”. However, as of yet, the focus of compassionate conservation has been to look for and embrace solutions to conservation problems that allow us to fulfill both duties. Win-win solutions are surely acceptable to all conservationists—compassionate or not. Even if one disagrees about how our competing duties ought to be ranked, if there exists an action that allows us to fulfill both, then that action is the action that is likely morally correct. Trying to find these win-wins often requires imaginative thinking and new approaches—something that compassionate conservationists tout and offer. In that spirit, they should embrace and promote emerging genetic technologies that have a great potential to alleviate the moral conflict between individual organism and species. I argue that given their founding premise that we have an obligation to look for win-win solutions to conservation problems, they have an obligation to support the investigation and development of genetic modification technologies for conservation purposes.

In the next section I will introduce one such technology and argue that it promises to achieve more win-win solutions in conservation biology.

5. Embracing genetic technologies to avoid difficult moral choices.

The genetic technologies that I want to focus on—CRISPR gene drives—involve the genetic modification of organisms; modifications that will, over a certain amount of generations, go to fixation in a population and become ubiquitous (Esvelt et al. 2014). Genetically modifying organisms used to be incredibly expensive; however, this is changing with the introduction of the CRISPR-Cas9 system (Marris 2017). This new genetic technology harnesses an evolved immune response found in bacteria to make precise germline genetic modifications. CRISPR technology allows us to delete, add, or rearrange the genetic elements of an organisms’ DNA. Furthermore, not only can the CRISPR system make precise edits, but these technologies are cheap. It cost about 100 dollars per use (Marris 2017).

Modifying the germline of an organism makes it the case that the “edits” will essentially have a 50% chance of being inherited by the offspring. This is because each parent only gives half of their genes to their offspring.

This is where gene drives come in. As Esvelt and Gemmell explain, “encode a desired genomic change along with the components of the CRISPR system, and it will

cut and replace the original sequence with the new version in each generation” (2017, 1). Hence the modification will appear in 100% of the offspring and in 100% of the offspring’s offspring, taking the genetic modification to fixation in any freely interbreeding population. Gene drives equipped with the CRISPR system would allow conservationists to introduce genes into populations of organisms and make sure those traits became universal (Marris 2017). Problems with having novel traits selected against or getting swamped out by larger numbers of wild-type traits would theoretically no longer be a problem (Esvelt et al. 2014).

I will now to return to the two case studies and explain how gene drives could help the conservationists escape “impossible moral choices” and argue that this creates a moral obligation to support at least the research phase of the technology.

On Gough Island, CRISPR gene drives could allow for conservation biologists to modify some mice in the lab to carry a synthetic gene. Modified mice would be released on the island and allowed to interbreed with the resident population. Having a single copy of the modified gene wouldn’t affect the mouse, but having two would make it infertile. Population modelers have created computer simulations of this approach that suggest adding as few as 100 mice with the gene drive could quickly push the gene through a population of up to 50,000 mice. In less than five years, all possible mates would have a copy, meaning that all offspring would be infertile and the population would crash to zero (Prowse et. al. 2017). No mice would be killed; they would simply fail to reproduce.

The technology creates a win-win and, as a side benefit, allows us to avoid the hard question of ranking these duties when they conflict. This approach is under active investigation by a consortium of public and private researchers collected as the Genetic Biocontrol of Invasive Rodents (GBIRD) program. Beyond smaller islands, the entire nation of New Zealand is already thinking about developing the technology to help their Predator Free 2050 initiative, which aims to eradicate rats, possums, and stoats from the country. I argue that these researchers and governments are on firm moral ground in working on developing these technologies rather than being content with culling regimes that have no foreseeable end.

Gene drive technology could also potentially help at Arid Recovery, though my thoughts on this are more theoretical. The natural selection that they are using to address prey naiveté is a very slow, blunt tool that operates only because of massive numbers of potentially painful and untimely deaths. The authors of the proposal recognize that their project may take some time, but they don’t see another option to help introductions succeed. They claim “If we aim to restore ecosystems where introduced predators interact with naïve prey, *something bold must be performed*. Viewed this way, there is a moral imperative to explore novel management strategies.” (Moseby et al. 2015, 6, italics added).

I agree that something bold must be performed; however, there may be other ways to inculcate in these organisms the appropriate anti-predator response that don’t involve the death of many endangered individuals or continual mass killing of the introduced exotics, something that the project managers also clearly see as an ethical issue (Moseby et al. 2015). If CRISPR engineering for anti-predator savvy can leapfrog hundreds of years of marsupial death, than it would likely be the morally correct action.⁶

⁶ My analysis on animal interest has been mainly framed in terms of thinking about their suffering and wellbeing. Some might think that what makes killing these animals so wrong is rather that they are

Cognitively enhancing endangered naïve marsupials with the use of genetic technologies would allow conservation biologists to both save endangered species, and not harm the introduced foxes and cats. If this were a possibility, the genetic technology would again also allow us to avoid the hard question of whether it is morally permissible to kill some individuals for the benefit of the species at large.

Cognitive enhancement of marsupials is just one possible option; others could be explored. Perhaps modifying some naïve marsupials to be slightly larger would get the same results. I don't want to give the impression that cognitively enhancing marsupials is the only way forward, I merely want to highlight the technology's potential to save species, prevent suffering and so help us escape epistemically difficult moral choices.

6. Potential objections to using genetic technologies.

In this section I want to address some potential objections to genetically modifying animals—using gene drives equipped with the CRISPR-Cas9 system—for conservation purposes. One reason to engage these objections is that there is already opposition to the idea. In 2016, a group of prominent conservationists, including Jane Goodall and David Suzuki, released an open letter condemning of the technology. They wrote, “we call for a halt to all proposals for the use of gene drive technologies, but especially in conservation (Civil Society Working Group on Gene Drives, 2016).” I will address the concerns mainly in the context of the two case studies presented in this paper.

6.1 *There may be terrible unexpected negative consequences given that the modifications are permanent.* Whenever a new technology is proposed for use in conservation there is always the possibility of unexpected ecological consequences. This is not a new problem to conservation. Whenever any conservation action is taken there is always the possibility that there will be unforeseen ecological consequences—even when only traditional conservation tools are used. Any obligation to support the investigation and development these technologies doesn't entail that they should be embraced blindly and supported without reservation. The obligation to investigate and develop these technologies should be undertaken in a cautiously optimistic fashion.

For example, most conservation biologists would likely advise that enhancing marsupials using monitored natural selection—as is being trialed at Arid Recovery—should be done in a cautious fashion. After all, selection for appropriate behavior responses to predators may bring along other novel behaviors for the ride, behaviors that could cause suffering or extinctions themselves; hence, the need for close observation of these animals before they are released in to the wild. Using genetic technologies to try to accomplish the same end without the suffering should have similar if not stricter safeguards and observation periods before animals are released into the wild (Rohwer 2018).

“subjects of a life” (Regan 1985) and that gives them intrinsic worth. If this is why one thinks it is wrong to kill animals for conservation purposes, then one should also be in favor of these genetic technologies, since the modified animals would still get to live their lives and not have them cut short by a poison, trap, or bullet.

Another safeguard against unintended consequences is to make sure the technology is responsibly regulated. Good regulation of the technology should be developed and implemented as the technology itself is developed. In the United States, as of August 2017, the food and drug administration (FDA) is in charge of regulation of animals that have been genetically modified to include gene drive systems (Meghani and Kuzman 2018). However, the current regulatory framework to be used for genetically modified animals has been criticized for not including enough opportunities for public participation and for using a too narrow risk assessment in terms of ecological impacts (Meghani and Kuzman 2018). Furthermore, animals don't recognize country boundaries—hence the call for a global regulatory framework for this new technology that is transparent, driven by stakeholders including representatives for the interest of nonhuman world (Kofler et. al. manuscript). Truly good regulation can help mitigate potential negative consequences when implementing a new technology.

However, some might think that any implementation of genetic technologies is an irresponsible action, since the genetic modification would be to the germline and hence any negative consequences would be permanent. This, I believe, is the main reason that certain conservationists have called for a categorical halt to gene drive proposals. Returning to the case of Gough Island, we can see that it would indeed be troubling if one of the modified mice escaped from the island and mated with mainland mouse, potentially causing the global extinction of the house mouse. It certainly seems odd to try to prevent an extinction by setting up the possibility of another extinction. This is a legitimate worry, but the technology is young, and to categorically oppose research into the technology in its infancy seems too hasty.

Furthermore, gene drives that are self-limiting in scope are already being researched and promoted (E.g. Esvelt and Gemmell 2017). For example, so-called “daisy drives” break up the CRISPR components across multiple locations across the genome, only some of which are pushed by a gene drive, but all of which are necessary for the modification to take place. After a certain number of generations the components that aren't being driven become less common and the effect ends. A gene drive that drives the trait of infertility thus couldn't make it far enough to push the species to extinction. Daisy drives are a promising way to mitigate the risk of extinction via gene drives (Esvelt and Gemmell 2017).

6.2 Genetic technologies could harm the integrity of individuals, species, and ecosystems. As I mentioned at the outset, integrity is an important concept to conservation biology. Of course how it is used and what is supposed to refer to has differed from author to author. Here I'll try to give a very general account of how the concept is used in the field.

Integrity in the most primary sense denotes wholeness. I want to discuss this wholeness at different levels of biological organization: individuals, species, and ecosystems. Integrity does refer to a historical wholeness at each level, but is slightly different depending on which level of organization one is looking at. The individual integrity of an organism refers to individual wholeness. We would say that an individual's integrity is compromised if, for example they lose an appendage or some foreign element has been introduced to the organism that did not exist before. So it is not

mere change (like organismal development from fetus to adult), but deviation from the organism's given biological traits.

Species integrity is similar. Species change over time and this slow evolution does not threaten their integrity. Generally speaking, when conservationists talk about threats to species integrity, they refer to anthropogenic events that have made acute changes to the species. For example, human-caused population declines that lead to inbreeding depression or human-caused species movements that lead to hybridization events that would have been highly unlikely without human intervention.

Ecosystem integrity is the highest level of complexity and usually the focus of conservation biologist. An ecosystem has more integrity if the kinds of organisms that lived and evolved in that area continue to live together and persist through time. Shared evolutionary history or historical continuity of kinds of organisms can indicate ecosystem integrity. Admittedly, the timescales used by conservationists to define what an ecosystem should look like tend to be biased to more recent and shorter timescales. Nevertheless, once an ecosystem starts changing with, for example, new organisms moving in or old ones dying out, the integrity is compromised. Of course integrity of individuals, species, and ecosystems come in degrees; we can have a loss of a gain in integrity.

One might think that using CRISPR gene drives is wrong since we have obligation to protect the integrity of individuals, species, and ecosystems. Genetic modification could be seen as a direct assault on that integrity and hence morally wrong. I think this objection is misguided at each level of biological organization and that the technology could support integrity, or at least cause less of a loss of integrity than traditional conservation interventions.

Let us start with individuals. There are many cases where it is justified to compromise an individual animal's integrity. For example, a dog's leg is amputated to save it from cancer. Without the reduction in integrity the dog would die, causing the complete annihilation of integrity. Analogously then, modification of marsupials would also seem justified. As in the case of the dog, the reason to compromise the integrity is essentially to ensure the continued existence of the individual, who would otherwise certainly be eaten upon release into the wild. The third option—to keep the entire species in captivity indefinitely—would also compromise their genetic integrity, plausibly to a higher degree, given that there would be selection for amenability to captivity, which could substantially change their behavior and physiology (Ford 2002, O'Regan, 2005).

One might think that the case that involves the mice and seabirds is not as clear-cut because the changes to the mice are not for their benefit. Are we not then harming the mice that are modified by denying them the chance to reproduce? However, this claim runs into non-identity problems (Palmer 2010). We cannot counterfactually say that the mice would be better off had the modification not occurred, since their existence is contingent on the modification. The offspring of a wild mouse and a mouse introduced by researchers would never have existed to be harmed were it not for the researchers' intervention. And the same can be said of their descendants who would inherit the modification. Hence, in the case of the mice, any particular individual's slightly different constitution is present from conception and necessary for the existence of the individual, so it is hard to think that the individual's integrity is compromised or that if it is, that that this constitutes a harm, since you can't be worse off if you don't exist.

When it comes to species integrity there is nothing that needs to be said about the case of Gough Island, since the species of mice will not be modified; rather, one subpopulation would be completely eradicated, taking their modification with them into oblivion. The species *Mus musculus* would be unchanged. But the case of the Australian marsupials is different. The proposed intervention would change the genetic make up of every existent individual, and hence the species. Is this not wrong? One reply could be that species don't have integrity. There is no wholeness to a species; they are too gappy, fluid, and dynamic. Every individual has a different set of genes; there is no single definitive genome. If species don't have integrity, then there is no reason to worry about losing integrity.

What is more, even if one defends the existence of genetic integrity, it may not be inherently valuable. Rohwer and Marris have argued that it is a proxy value, something that we might want to look out for, not for its own sake, but as a heuristic for protecting other more plausibly valuable things such as biodiversity and individual flourishing (2015).

Even if species do have integrity and integrity is inherently valuable, it may not *always* be wrong to compromise that integrity. Many, if not all, conservation actions influence the genetics of populations and species. Moving sets of individuals in translocation actions, erecting fences that divide interbreeding populations, protecting corridors that connect previously isolated populations, changing conditions through habitat restoration, taking species into captivity, exposing animals to cats to prompt adaptation to novel predators—all these interventions can change gene distributions in the population.

Some may categorize these modifications as “natural” and lab-based modifications as unnatural and hence problematic for integrity. The idea here is that natural change doesn't compromise integrity. I think this is mistaken. First the idea that the natural is good seems highly problematic (Comstock 2010). Second, it is hard to think that the word ‘natural’ even meaningfully refers to anything that exists now and so cannot be a good reason to prefer one action over another (Vogel 2015). If we take ‘natural’ to mean something non-anthropogenic, then many interventions in conservation would be unnatural. Think of the ongoing recovery of the California condor (Farnsworth 2015), which involved taking the entire species into captivity and technology including radio collars and simulated puppet mothers or the effort to save the peregrine falcon, which involved importing and hybridizing a subspecies from Eurasia (Tordoff & Redig 2001). It would seem to be difficult to call these projects natural in any sense of the word. If those projects were morally permissible even if they compromised integrity, then the gene drive projects likely would be too—both are modifying the genetics of individuals and hence species, but this small loss of integrity is justified if the other option is the extinction of the species, and with it the annihilation of that species' integrity.

Finally, I want to discuss ecosystem integrity. One possible response to worries about ecosystem integrity is to deny that such a thing exists. Even more so than species, ecosystems are inherently dynamic and it doesn't make sense to attribute them the property of integrity. I am sympathetic to this view, but acknowledge that there is widespread belief in and concern over ecosystem integrity. Thus I will, for the sake of argument, assume it does exist and is valuable.

The main thrust of the argument for the conclusion that compassionate conservationists (really all conservationists) have a moral obligation to support the investigation and development of genetic technologies has been the potential to save species while avoiding all the killing of sentient creatures. However, I want to quickly note again that saving species is logically a means to preserving and protecting current biodiversity and ecosystem integrity. When a species goes extinct a component of a system is gone, and hence necessarily its integrity will be compromised. Eradicating mice of Gough Island would ensure the safety of a native bird and eliminate an introduced non-native, thus increasing the system's integrity.

Here, removing an organism restores integrity but reintroducing organisms can also restore integrity. Imagine that my proposal to genetically modify marsupials became a reality and led to successful continent-wide reintroduction of certain marsupials. The ecosystems that were missing several interacting components would now have those components back. Species that historically moved seeds from place to place, interacted with one another as predators and prey, and dug soil-aerating burrows would return, changing whole ecosystems (Mills & Letnic 2018). The various ecosystems in the Outback, it would seem, would now have more integrity they did when those organisms were missing. This would hold true even if some components were slightly modified, since ideally the only behavioral change would be a lack of prey naïveté and all their other behavior and relationships with other organisms would be unchanged. Hence the technology, if implemented, would increase rather than reduce ecosystem integrity. If ecosystem integrity is something that one values, then I think this paper gives us additional reasons to support genetic approaches.

6.3 Developing the technology will cause an unjustifiable amount of suffering. I think this objection may pose the biggest challenge to my argument, which is directed primarily at compassionate conservationists. Researching genetic approaches will involve experimentation and trial runs on individual organisms. As I write, experiments on living mice are already underway. Given that the process of developing the technology will involve harm to individuals, this could be sufficient reason for compassionate conservationists to reject the technology. After all, compassionate conservationist have adopted the moral imperative of medical ethics of “do no harm” (Wallach et al. 2018).

Much of the research concerning these genetic technologies is occurring in the biomedical world. CRISPR technology has great potential to eradicate certain genetic diseases in the human populations (Ledford 2017). CRISPR gene drives, in particular, have the promise to eliminate mosquito-borne diseases like malaria, which killed around 440,000 in 2015 (Burt et. al. 2018). Hence, it seems inevitable that regardless of the objections of those dedicated to animal welfare, the technology will be developed. There will be no stopping it.

Given that it will be developed, it seems wrong to refuse to use it to prevent future suffering simply because animals suffered during its development. However, implementation for conservation purposes will involve at least some additional suffering of sentient animals, since for each project some eggs will be harvested and modified and then implanted in captive animals. However, if the technology is already advanced, well understood, and safe and if implementing the technology for conservation would prevent killing and greatly lessen the amount of suffering of wild individuals caused by

conservationists, then it is hard to think that a compassionate conservationist could avoid the entailment that they have a moral obligation to support it. A Gough Island type project might involve surgical interventions on some dozen mice and temporary captivity for some 100 of their offspring, before their release. That would be balanced against many thousands of wild mice that would not have to be poisoned and die slowly from internal and external bleeding over the course of six days.

Here I stress the idea that sometimes a minimal amount of suffering of sentient beings can be justified. I think one can still embody the virtue of compassion while causing a minimal amount of suffering (harvesting and implanting modified eggs), especially if these actions are done to stop a large amount of killing.

Looking at contemporary practices in the two cases this paper focuses on and the tremendous potential for reducing suffering and stopping the killing with genetic technologies, it seems hard for the compassionate conservationist to reject the technology on grounds that it will involve some minimal amount of suffering. Almost all conservation actions involving humans causing some animal suffering, including some projects proposed by compassionate conservationists—like introducing predators back into ecosystems and eliminating predator control to suppress introduced mesopredators instead of killing them directly (Wallach et. al. 2015).

Admittedly, compassionate conservationists, as I noted above, are primarily concerned with killing and harms caused by moral agents; that is, by conservationists. However, I don't see how they can say that reintroducing wolves to a population doesn't violate the directive of "do no harm". Intentionally introducing a wolf into an ecosystem where they were previously eradicated does harm individuals. Especially when you learn about how wolves kill (Marris 2017a). Whether you undertake it yourself or cause it indirectly, if you take an intentional action that will inevitably lead to suffering or death, then you are the cause.

The justification for the reintroduction of predators could be that less harm will be done by restoring the actual organism to its ecological role than having humans try to replicate its ecological function. This is perhaps why Wallach et al. (2018) qualify the notion of harm in one of the later quotes of their recent paper. They write, "Conservation risks reducing itself to a form of fundamentalism if it fails to take serious steps to limit practices that cause *severe* harms to individuals" (Wallach et al. 2018, 14 italics added). I claim that the kinds of harms that would be involved to implement the technology don't qualify as severe, but they must certainly be recognized as harms.

I have touted emerging genetic technologies as a way to escape certain hard moral choices. However, we can't completely escape moral reasoning in conservation biology. But this technology does give us a third option in some cases that without it really do seem like "impossible moral choices" like the choice is between killing many individuals in very unpleasant ways for them (think the poisoning of the mice) or letting a species go extinct. It seems like either way we would be failing a duty—either to save species or not kill sentient creatures. However if the choice is between genetically altering a few individuals such that eggs must be harvested and implanted into individuals and letting a species go extinct, the former option seem clearly morally superior. Causing suffering is an inevitable part of intervening and interacting with nature; it will probably never go completely away, regardless of whether this harm is done directly or indirectly. We must recognize that we are causing it and look for ways to minimize and potentially stop it—

this allows for actions that still manifest the virtue of compassion, while causing minimal harm. I think this holds in cases where the minimal suffering to those individuals can result in the end of widespread killing and suffering for all the new generations to come.

7. Conclusion. I have argued that compassionate conservationists have a moral obligation to support the investigation and development of genetic technologies for conservation purposes. I have argued that these kinds of technologies have the potential to allow us to free ourselves from ranking different and conflicting values and can, in some cases, allow us to avoid these epistemically difficult moral situations. Genetic technologies, like gene drives, have a great potential to be exactly the kind of win-win solutions that compassionate conservationists are looking for. There is a high probability that these technologies will allow us to save species, stop the killing, and greatly reduce the amount of suffering to individual organisms to a sufficiently minimal level. Furthermore, legitimate objections to the technology I think are being addressed—for example, the development of daisy drives—and other objections don't hold up under scrutiny. Furthermore, I think that these technologies also align with the classic conservation goal of restoring ecosystem integrity. I want to end this paper by noting that there is another reason to think compassionate (but really all) conservationists have this moral obligation.

Wallach et al. (2018) frame their movement in the terms of virtue theory where the focus is on the character traits of good individuals. I think that if these technologies are safely developed and employed, that there is a real possibility that we could eliminate behavior that is quite plausibly damaging to our moral character. Here, I want to focus not on professional conservationists, but rather on citizens who undertake traditional conservation actions. For example, conservationists in New Zealand actively recruit schoolchildren to participate in possum hunts. They have schoolyard games that encourage the symbolic abuse of introduced possums and stoats. There are picture books that glorify the killing of stoats (Hunt & Warne, 2017). Moreover, after successful possum hunts children have been known to hold contests to see who can throw a dead possum the farthest, or dress up dead possums in the most outrageous costumes.

I don't want to minimize the problems that these introduced animals pose to the flora and fauna of New Zealand; however, conceptualizing these animals as bad and unworthy of any moral respect or care risks tainting our moral character. I worry that these citizen conservationists, filled with the rhetoric of destroying invaders, end up making problematic classifications of animals where some count and others don't. Interestingly cats, which are also beloved house pets, are not on the kill list in New Zealand, even though they are very enthusiastic predators of native animals. Furthermore, the culture of killing that is being fostered in New Zealand might also obscure other, perhaps larger factors, which thwart the recovery of native fauna, like loss of habitat due to agriculture (Linklater & Steer 2018). My worries about character are shared by compassionate conservationists (Wallach et al. 2018). However, while I think these concerns are very plausible, they are ultimately speculative. More empirical research should be done. If it is the case that "possum smashing" makes one vicious, as seems likely, gene drives could one day stop these kinds of practices and hence help us, in some cases, not only avoid the hard choice between saving a species and causing much death and suffering, but also escape actions that could plausibly damage our moral character.

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DISCUSSION

Agenda Item 4.3

General Education Reform Update

Background

Over the summer, the General Education Review *ad hoc* Committee (GERAC), comprised of faculty and staff, met and made recommendations on the general ed reform model. These recommendations move the university closer to a sustainable, forward-looking, and educationally effective model for general education. While the committee considered various lenses that need to be applied to move toward implementation, there are elements that will require further analysis and elements of the model that will need further refinement. The Office of Academic Excellence reviewed the recommendations and the model's compatibility with new statewide transfer structures. Deeper analyses are needed of the impact on program curriculum maps, staffing needs and other costs that will accompany implementation. These analyses are critical in developing timelines, budgets and necessary awareness for the administrative review phase and are part of the work that must be done before a sustainable, flexible, and viable model is reached.

We are now in the administrative review phase, collecting necessary data for analysis and further refinement of the proposed model, including the impact on transfer students. Affected faculty and administrative units will be consulted. The aim of the work is to produce a product that has well-understood and manageable impacts, along with an associated budget and implementation timeline, for review by Executive Staff with a final recommendation to the President for an implementation strategy.

Recommendation

None. Item is informational only.

Attachments

Excerpts from Work In-Progress Recommendations of the Goal IV Team: GERAC

WORK IN-PROGRESS DOCUMENT



Recommendations of the Goal IV Team: General Education Reform Ad-Hoc Committee (GERAC)

October 5, 2018

GERAC Co-Chairs

Dan Peterson
Wendy Ivie

GERAC Members

Steve Addison
Brandy Brown
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Ryan Madden
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Executive Summary

The General Education Task Force (GERTF) was formed in Spring 2013 to conduct a comprehensive review of university general education requirements and develop recommendations to improve the general education program. The report introduced a new Essential Studies model and philosophy for general education at Oregon Tech. The present report considers the recommendations from GERTF, considers modified options to those recommendations, and sets forth a plan and timeline for implementation.

This report considers six options for modifying the original Essential Studies model proposed by GERTF. The workgroup was considerate of the essence and rationale of the original Essential Studies model, including Essential Studies Learning Outcomes (ESLOs), programmatic integration, vertical integration, the Essential Studies Synthesis Experience, flexibility, and subject matter expertise. The result of the discussions led to several considerations for changes to the model from continuing to do what is currently being done with Essential Studies to full change and implementation of the proposed Essential Studies model.

As a result of those discussions, the workgroup recommends that Option 2 be adopted during Fall 2018 and implemented by Fall 2020 with work towards this end beginning Winter term 2019. Also, the workgroup recommends that investigation into the possibility of implementation of Option 3 begin during Winter 2019. The workgroup was mindful about budget in its deliberation and believes finances, academic quality and improved student learning should be driving decision-making factors in an administrative commitment to general education changes.

Introduction

The General Education Task Force (GERTF) was formed in Spring 2013 to conduct a comprehensive review of university general education requirements and develop recommendations to improve the program. The work was inclusive of the voices of faculty across the institution and careful research. The Report of the General Education Review Task Force (See Appendix A) was delivered in Summer 2016. The report introduced a new Essential Studies model and philosophy for general education at Oregon Tech. Although the General Education Advisory Committee (GEAC) reviewed the GERTF report (see Appendix B) the recommendations from GERTF were not immediately implemented as a result of changing university leadership, concerns with new model implementation, and a lack of committee authority for implementation. The present report considers the recommendations from GERTF, considers modified options to those recommendations, and sets forth a plan and timeline for implementation.

Essential Studies Learning Outcomes

The Essential Studies general education model is built on Oregon Tech's six Essential Student Learning Outcomes (ESLOs) which support the institutional mission and core themes. The six ESLO's can be found below and form the pathways for general education requirements in the proposed Essential Studies model.

1. Communication
2. Inquiry and Analysis
3. Ethical Reasoning
4. Teamwork
5. Quantitative Literacy
6. Diverse Perspectives

Ad-Hoc Workgroup

Despite the delay in implementation, work to understand the model and to assess elements of it continued over the past couple of years through the Office of Academic Excellence and the General Education Advisory Council (GEAC). In Spring 2018, Provost Gary Kuleck formed a multi-disciplinary ad-hoc work group to review and refine the Essential Studies general education model and to make recommendations regarding how to clearly and flexibly respond to constraints, opportunities, and concerns raised since the GERTF final report. The ad-hoc work group was comprised of faculty representing multiple university departments and campus locations, as well as representatives from key administrative offices including the following members:

Recommendations of the Goal IV Team: General Education Reform Ad-Hoc Committee (GERAC), October 5, 2018

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GERAC Co-Chairs

- Dan Peterson, *Communication* (Klamath Falls)
- Wendy Ivie, *Registrar's Office* (Klamath Falls)

GERAC Members

- Brandy Brown, *Online Education* (Klamath Falls)
- Phil Howard, *Computer Systems Engineering Technology* (Klamath Falls)
- Ryan Madden, *Humanities & Social Sciences* (Portland-Metro)
- Rose McClure, *Natural Science* (Klamath Falls)
- Deanne Pandozzi, *The ROCK* (Klamath Falls)
- Randall Paul, *Mathematics* (Klamath Falls)
- Stephanie Pope, *Budget and Planning* (Klamath Falls)
- CJ Riley, *Civil Engineering* (Klamath Falls)
- Matt Schnakenberg, *Communication* (Klamath Falls)
- Rich Carson, *Medical Imaging Technology* (Klamath Falls)
- Steve Addison, *Mechanical & Manufacturing Engineering* (Boeing)
- Hope Corsair, *Electrical Engineering & Renewable Energy Engineering* (Portland-Metro)

The Charge

At the outset of the ad-hoc group's work in summer 2018, Provost Kuleck and Interim Director of the Office of Academic Excellence, Seth Anthony, provided the following charge to the group:

With full attentiveness to the constraints and opportunities facing Oregon Tech, particularly differences between sites, delivery modes, curricula, and student populations, as well as internal and external fiscal, political and enrollment pressures, the ad hoc Working Group on General Education Reform is charged with:

- (1) *Producing a refined model for general education reform that draws on the Essential Studies model which clearly and flexibly responds to constraints, opportunities, and concerns raised since the GERTF final report,*
- (2) *Developing an implementation plan and timeline that includes both academic and non-academic components and defines responsibilities, and clearly and specifically identifies necessary resources required for implementation, and*
- (3) *Including within or alongside these products sufficient detail and analysis to offer a persuasive case that this model and plans are implementable and sustainable for Oregon Tech.*

Recommendations of the Goal IV Team: General Education Reform Ad-Hoc Committee (GERAC), October 5, 2018

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Process of Review

In order to refine the model, develop an implementation plan, and designate timelines for action, GERAC was divided into four subgroups. Each group was given a “lens” by which to view the model. The lenses included transferability, budget, student, and academic. The groups were organized with faculty and staff members based upon interest or specialty and considered the following:

Transferability

- Flexibility of the model to accept credits in specific ESLOs.
- Influence of the Essential Studies Synthesis Experience (ESSE) on transfer students.
- Community college and the Admissions Office training on the new curriculum.
- Time to complete transfer evaluations by the Registrar’s Office and general education department chairs.
- Legislative issues and requirements.
- Articulation agreements and statewide block articulations.
- Student time to completion.
- Concerns regarding credit by examination and credit for prior learning.
- Current university transfer policy.

Budget

- Faculty and staff workload issues, including new faculty and staff needed for implementation.
- ESSE development, workload, and adjunct issues.
- Influence on Admissions Office, the Registrar’s Office and any other offices supporting general education.
- Budget and financial impact scenarios.

Student

- Student time to completion (freshman and transfer).
- Recognition of the importance of general education in the experience of students.
- Influence of the ESSE.
- External marketing, public information, etc. about changes to general education.
- Impact on recruiting and enrollment.
- Credit neutrality of the model, keeping it as credit neutral as possible.

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Academic

- Flexibility of the model to accept credits in specific ESLOs.
- Importance of faculty content expertise in general education courses.
- Recognition of the significance of general education by staff, faculty and administration.
- Creation and instruction of the ESSE.
- Influence on programs and their curriculum maps.
- Legislative issues and requirements.
- Influence on current university policies and outcomes.
- Current university and faculty policy.
- Advising considerations.
- Integration of general education and program coursework.

Modification Recommendations

The work of the subgroups and collective workgroup yielded options for modifying the original Essential Studies model. The workgroup was considerate of the essence and rationale of the original Essential Studies model, including the Essential Studies Learning Outcomes (ESLOs), programmatic integration, vertical integration, the Essential Studies Synthesis Experience, flexibility and subject-matter expertise. The result of the discussions led to several considerations for changes to the model from continuing to do what is currently being done with Essential Studies to full change and implementation of the proposed Essential Studies model. The options below represent variations discussed by the group and considerations of each option.

Option 1: Status Quo (Not Recommended)

Delay the reform until a full assessment cycle is completed. Oregon Tech would continue to use its current general education model and continue to assess ESLO tagged courses as part of our current assessment model. Development of cross-disciplinary courses that address all six ESLOs would be encouraged. Information would continue to be gathered from these and other sources with a new general education model resulting at the end of the current assessment cycle in 2020-2021.

Considerations

- Provides the opportunity to gather more information.
- Provides time to adjust to new leadership and changes in faculty workload.
- Budget neutral.
- Loss of momentum for general education reform.
- Current general education requirements are not clearly aligned with recently adopted ESLOs

Recommendations

The workgroup does not recommend this option because of the general acceptance of the ESLOs, progress being made toward tagging courses as part of the ESLO model, and programmatic changes already made in consideration of the ESLOs. This option would stall already dwindling momentum toward any necessary general education reform.

Option 2: Essential Studies Learning Outcomes Pathways (Recommended)

Requires a certain number of courses supporting each ESLO pathway (See Figure 1), but does not include vertical integration (foundational, practicing, capstone), program integration (no program integrated practicing) or the ESSE. For further information on vertical and program integration, and the ESSE see Appendix A.

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9 Humanities:	Inquiry & Analysis: Humanities	Inquiry & Analysis: Humanities	Ethical Reasoning			
12 Social Science:	Inquiry & Analysis: Social Science	Inquiry & Analysis: Social Science	Inquiry & Analysis: Social Science	Diverse Perspectives: Social Science		
18 Communication:	Speech 111	Writing 121	Writing 122	Speech 221	Communication	Diverse Perspectives: Communication
16 Math/Natural Sciences:	Quantitative Literacy: Statistics	Quantitative Literacy: Finance	Inquiry & Analysis: Natural Sciences	Inquiry & Analysis: Natural Sciences		
= 55 hours						

Figure 1. Example of courses supporting ESLO pathways

Considerations

- General education requirements are intentional, requiring courses that support institutional and programmatic goals.
- Some of the work has already been done by ESLO committees.
- Fewer issues with transfer courses than with other options.
- Accommodates all current institutional curricular designs.
- Ties learning to ESLOs, enhancing the student experience.
- Supports industry-recognized student general education needs.
- ESLOs may not be re-enforced later in upper division courses.
- Possible issues with credit hour neutrality in a few programs.
- Possible issues with transfer credit loss.
- Potential influence on the workload of some general education faculty.
- Course availability by campus or mode.
- Banner transfer database updates.
- DegreeWorks updates.

If proposed model changes are accepted, all current required credits are maintained. All general education courses in the Oregon Tech database will need to be tagged with a new general education designation. Departments must send all courses through the ESLO

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committees to determine the appropriate ESLO tag. Double dipping (the ability of one course to satisfy multiple ESLO pathways within general education) will not be approved. Programmatic courses will not need to be tagged by ESLO committees unless they are fulfilling general education requirements. Once all general education courses are reviewed by the ESLO committees, the Registrar's Office will begin the task of assigning all Oregon Tech general education courses and transfer courses with the appropriate attribute/pathway tag in Banner. This labor will require a considerable amount of time and effort from general education faculty and other staff.

The focus on general education pathways will make the model straight forward and easy to communicate for students, faculty, and staff. The simplicity of this approach makes understanding the model straightforward for internal and external audiences.

Recommendations

The workgroup strongly recommends adoption of this option for four reasons. First, the Essential Studies Learning Outcomes Pathways create intentionality in general education outcomes for all programs and locations. Second, this option encourages continuous improvement in the general education at Oregon Tech, which will benefit student learning in an ongoing manner. Third, the option provides greater focus on the importance of general education in all programs. Finally, the option meets industry expectations for the learning Oregon Tech students have that make them unique from other institutions in the state of Oregon.

Option 3: Option 2 with the addition of the ESSE (Recommended with further assessment)

The ESSE should be a cross-disciplinary, project-based course, taken late in the student's experience, bringing together all six ESLOs.

Considerations

- Opportunity for cross-disciplinary teamwork for both students and faculty.
- Provides some vertical integration or general education learning at lower and higher levels of the student's educational experience.
- Course development needs clear explanations and funding model with attention to faculty workload.
- Issue for how ESSE workload will be assigned in team taught classes.
- ESSEs must be available and effective in all modes of delivery.
- ESSEs must be tagged under COM, HUM or SOC.

Recommendations

The workgroup recommends that additional ESSE exploration occur beyond the existing ESSE courses. Intentional ESSEs should be created with the purpose of gathering feedback about the viability of the concept for Oregon Tech. The workgroup recommends pilot ESSEs focus on a variety of delivery modes and learning situations including distance education, working professionals, industry partnerships, etc. The goal of these experimental courses is to better understand the concerns above through deliberate course output. Further discussion is needed on incentivizing faculty to create ESSEs.

Development of experimental courses should begin during winter 2019, with the expectation that courses will premiere during fall 2019 and during the rest of that academic year. This effort should continue to be overseen by the ESSE committee under the direction of General Education Advisory Committee and the Office of Academic Excellence.

Option 4: Program Integration (Recommended for consideration after implementation of Option 2)

This option connects program courses and the ESLOs learned in general education courses. Program integration creates greater relevance of ESLOs within programs. Through the six year cycle of ESLO assessment and the tagging of courses, the institution has already begun the process of program integration to a certain extent, although some programs have participated in greater amounts than others.

Considerations

- Connection between the ESLOs and programmatic curriculum.
- Greater relevance given to general education by connecting to program courses.
- Influence of course approval and tagging process on programmatic curriculum.
- The relevance of ESLOs to all programs.
- Potential impact on transfer students.

Recommendations

The group supports the concept of connecting general education outcomes with student learning through program integration by continuing the six-year ESLO assessment cycle. However, there are still many details that need to be worked out for full program integration.

The six-year ESLO assessment cycle should continue as scheduled. Beginning in winter 2019, work should begin on reviewing the course tagging process to improve clarity and flexibility. This work should be completed through GEAC, under the direction of the Office of Academic Excellence.

Option 5: Vertical Integration (Not Recommended at this time)

Vertical integration is the idea that there are foundation level general education course and practice level general education courses. Vertical integration poses a problem for many transfer students that results in a loss of credits and perhaps a loss of students.

Considerations

- ESLOs are introduced and reinforced in more depth in a subsequent general education course.
- Serious transfer issues as a student attempting to transfer a large number of foundational courses will find that many will not transfer effectively.
- Difficult for programs with inverted curriculum as most general education is taken during the latter years of the program.

Recommendations

While the group sees benefits in vertical integration within the Essential Studies general education model, the transferability concerns outweighs the perceived benefits. By removing vertical integration from the Essential Studies model the loss of transfer credits, as seen in the 2017 Transfer Impact Study (See Appendix C), should be minimized. The Office of Academic Excellence should rework the Transfer Study based on recommended model changes to determine credit loss and report back to GEAC.

Option 6: Capstone (Not Recommended at this time)

Many programs at Oregon Tech have a capstone built into the curriculum where ESLOs could be integrated. Doing so allows some level of vertical integration and a connection between the ESLOs learned and programmatic curricula. This also creates a place where the ESLOs are emphasized again toward the end of a student's learning experience.

Considerations

- ESLOs are introduced in the individual programs, reinforcing the relevance of general education concepts within a chosen discipline.
- Potential credit neutrality issues if no relevant capstone course is required within the current curriculum.
- Concerns whether all six ESLO pathways and programmatic material can be achieved in one course.
- Faculty discomfort in assessing ESLO mastery at a capstone level.
- ESSE already provides a similar synthesis experience.

Recommendations

Reinforcing ESLOs in all programs and at all levels introduces numerous constraints. A capstone has intrinsic value but is not recommended for implementation at this time. The concept still needs to be investigated to determine if all six ESLOs and programmatic outcomes can be effectively assessed in one course. The workgroup also believes that ESSE exploration will provide valuable insight for whether faculty and students can teach and learn all ESLOs successfully in one course, thus demonstrating the possibility of doing so in capstones.

Implementation and Timeline

This report highlighted six options with a variety of possibilities that could be implemented. In summary, the workgroup recommends the following:

Recommendations

- Implementation of option 2 with exploration of Option 3, specifically the ESSE.
- The ESSE should be explored for long-term viability by intentionally considering teaching locations, interdisciplinary nature of the course, workload issues, etc.
- The ESSE should initially be tagged in an ESLO pathway in the Social Science, Humanities or Communication departments in order to ensure the ESSE is credited towards graduation requirements.
- Besides Option 1, no option is completely budget neutral.
- Special attention should be paid to faculty workload and staff necessary for implementation.
- Implementation should be led by a project manager appointed by the Provost. This person could come from the Office of Academic Excellence or elsewhere. The project manager will work with previously existing committees and offices to facilitate the change.
- The project manager should practice principles of shared governance and transparency following current university policies and guidelines.

Timeline

The progressive implementation should be completed by the Fall 2020 and follow these recommended timelines based on the university catalog cycle.

- The workgroup will provide to administration a report of its discussion and recommendations early during Fall quarter 2018 with the expectation that administration will make a decision about general education by the end of Fall quarter 2018. Data will be delivered to administration by the Office of Academic Excellence to assist in decision making.
- Office of Academic Excellence will redo the Transfer Impact Study during Fall 2018 and will review program maps to assess impact of revisions on departments.
- During Fall 2018, potentially impacted general education departments discuss implications to programs and provide feedback to the Office of Academic Excellence.
- General education departments and ESLO committees develop a comprehensive list of tagged courses during Fall 2018.
- At the end of Fall 2018 or early in Winter 2019, the workgroup's recommendations and administrations decisions should be shared with faculty and staff.

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- ESSE development opportunities should begin as early as winter 2019 with a possibility of courses being offered as early as spring 2019. This exploration phase should continue until 2020 at which point evidence-based decisions should be made about the viability of the ESSE as a part of Oregon Tech's general education.
- ESLOs should continue to be assessed in their regular cycles in order to make decisions about how to advance general education further.
- For clarity and ease of communication, a visual model of general education should be completed by Fall 2019 through the Office of Academic Excellence.
- By Fall 2019, development of internal and external marketing and communication regarding changes to general education is complete.

Conclusion

In summary, following the charge to refine the Essential Studies model, develop an implementation plan, and designate timelines for action, the workgroup collaborated with a desire to improve general education at Oregon Tech, making it more intentional, reducing barriers to students, improving the existing general education model, and enhancing student performance.

The workgroup recommends that Option 2 be adopted during Fall 2018 and be implemented by Fall 2020 with work towards this end beginning Winter term 2019. Also, the workgroup recommends that investigation into the possibility of implementation of Option 3 begin during Winter 2019. The workgroup was mindful about budget in its deliberation, and believes finances, academic quality and improved student learning should be driving decision-making factors in an administrative commitment to general education changes.

Option 2 with the exploration of Option 3 will require allocation of the following resources:

- Two new faculty lines in Humanities and Social Sciences (one at Klamath Falls and one at Portland Metro). Minimum HSS salary \$40,568 (\$68,139 with OPE). These positions are necessary for teaching an increased number of foundational ethics courses.
- One new temporary 1.0 FTE classified position in the Registrar's Office to assist in the tagging of general education courses and degree audits. Estimated salary \$31,284 (\$56,978 with OPE).
- Marketing dollars for communicating the new general education requirements to all campus and off campus constituents. Estimates include \$5,000 for printing and other materials costs and \$10,000 for possible campus events, travel or off-campus events to educate constituents about the new requirements.
- Stipends and course release time for faculty to incentivize development and/or teaching of ESSE courses during the two-year exploration and development period.

The General Education Reform Ad-Hoc workgroup respectfully submits our recommendation to the Provost for further administrative review and encourages follow-up meetings with the workgroup chairs and other committee members to provide additional depth and understanding of the recommendations. Further, the workgroup strongly recommends its conclusions and administration's decisions be shared with faculty and staff.

DISCUSSION

Agenda Item 4.4

Introduction to Cybersecurity Degree

Background

Degree Overview

The federal government recognizes the rapid growth in the gap between cyber threats and skilled cybersecurity professionals who are proficient in identifying, reporting, and responding to information system exploitations. As such, Executive Order 13800, Growing and Sustaining the Cybersecurity Workforce, calls upon public universities to “grow a dynamic and diverse cybersecurity workforce,” which is aimed to, “improve the Nation’s cyber posture and capabilities in the face of intensifying cybersecurity threats” (US-CERT, 2017).

The order stresses the importance of developing a diverse workforce through hands-on training delivered via work-based learning, internships, and virtual assessment environments. As the Northwest's premier public polytechnic university, Oregon Tech will develop well-rounded cybersecurity professionals through its proposed Bachelor of Science in Cybersecurity degree program.

The proposed B.S. in Cybersecurity is designed to produce graduates that will be ready to enter the workforce as entry-level cybersecurity practitioners, analysts, and penetration testers. Through the program, students will gain foundational knowledge in information systems with focused courses on vulnerability scanning, threat detection, system health reporting, and system defense operations. The curriculum will follow the core knowledge units designed for National Centers of Academic Excellence in Cyber Defense Education (CAE-CDE) prepared by the National Security Administration and the Department of Homeland Security. Furthermore, the curriculum will include topics established by the National Institutes of Standards and Technology’s (NIST) National Initiative for Cybersecurity Education (NICE) framework.

Program Outcomes

- a. Describe the tactics, techniques, and procedures used throughout the vulnerability assessment process.
- b. Evaluate risk in information systems and apply mitigation techniques to reduce impact to business operations.
- c. Perform information system vulnerability scanning and report findings.
- d. Identify information system exploits and apply proper incident response.

Expected degrees produced over the next five years.

6-year graduation rates published by the state of Oregon is ~63%.

	2021-22	2022-23	2023-24	2024-25	2025-26
FTE	28	35	44	49	66

Degrees will be offered at Wilsonville and Klamath Falls at inception and move online in 2021.

Strategically, Oregon Tech wishes to build from its current areas of strength into programs that can leverage that expertise and expand the impact of the institution. Market demand, by both the student and industry, is essential to proposing and developing any new program. A Bachelor of Science program in cybersecurity fits perfectly into this framework. The information technology program is consistently ranked among the top IT programs nationally. The B.S. Cybersecurity degree draws heavily from and builds a solid foundation upon the strengths of the IT and Management programs and expands them into the highly in-demand field of cybersecurity. There is currently a critical global shortage of trained cybersecurity professionals, and there are no other programs specifically focused on the applied practice of cybersecurity anywhere in the state.

The proposed B.S. Cybersecurity degree is consistent with Oregon Tech's mission of providing high-quality education combined with applied, real-world experiences to prepare graduates to enter the workforce as trained practitioners of their chosen discipline. This degree program focuses on creating well-rounded cybersecurity professionals. The B.S. Cybersecurity degree combines the necessary theory and frameworks to provide students with strong foundational knowledge, along with opportunities to apply their knowledge to real-world problems. Graduates of this program will have the required knowledge, skills and abilities needed to become successful professionals, with both a solid technical background and the "soft skills" that are necessary to succeed in today's work environment.

Timeline

- CPC – complete by the end of fall term.
- Provost – completes review by mid-December and submits documentation to Board of Trustees and Provost Council.
- Oregon Tech Board of Trustees – Provost Kuleck starts the discussion about the program in the November meeting (11/15/2018) and seeks approval at January meeting (1/24/2019).
- State Provost Council – Provost Kuleck starts the discussion about the program in the October meeting (10/2/2018), and will seek their approval at February meeting (2/5/2019). The documents are submitted 6 weeks in advance without board's approval that is provided at the February meeting.
- HECC – March
- NWCCU – start in April, approval may take several months, hopefully granted in July or August.
- Start program – fall 2019 (winter, if delayed). The program cannot be advertised without NWCCU approval. That means it will not appear in the catalogue of 2019-2020 academic year published in May. However, CYB courses that are already approved can be offered. Students can then apply them to the program that will officially start after NWCCU approval.

Recommendation

None. Item is informational only.

Attachments

PowerPoint presentation



Cybersecurity

Presented By:

Assistant Professor, Tracey Coon
Associate Professor, Sharon Beaudry

Executive Order

The federal government recognizes the rapid growth in the gap between cyber threats and skilled cybersecurity professionals who are proficient in identifying, reporting, and responding to information system exploitations. As such, **Executive Order 13800, Growing and Sustaining the Cybersecurity Workforce**, calls upon public universities to “grow a dynamic and diverse cybersecurity workforce,” which is aimed to, “improve the Nation’s cyber posture and capabilities in the face of intensifying cybersecurity threats” (US-CERT, 2017).



2,775 Vacant
Cybersecurity
Jobs

Cybersecurity Curricula



- 17 Faculty Business Degrees Core
- +
- 4 Faculty Information Technology Degree Core
- +
- 2 Faculty
 - CYB 201 Cybersecurity Fundamentals
 - CYB 301 Hacker Tools and Techniques
 - CYB 302 System Defense and Incident Response
 - CYB 303 Security Operation and Analysis
 - CYB 351 Network Security
 - CBY 411 Managing Risk in Information Systems
- 2 New 2019

Technology-Infused Business Degrees
Business-Infused Technology Degrees



3

Geographic Offerings

Fall 2019 launch in Klamath Falls and Portland Metro.

Fall 2021 launch as an Online program.

+2 yrs after on campus launch date

*Dependent on degree approval process



Accreditation
IACBE
 International Accreditation Council for Business Education



4

Pathways



Partnership Opportunities



Military Training
Industry Partnerships
Internships and Sr. Projects



Expected Graduates

	2021-22	2022-23	2023-24	2024-25	2025-26
FTE	28	35	44	49	66



Return on Investment

Breakeven at FY3 and ROI at 22.7%
4 year investment of \$1,790,198
Returned Profit of \$403,559 at end of FY4 based on Tuition
Additional Graduation Revenue of \$448,000
Totaling \$851,559

Budget was based on tuition dollars only.
If BS Cybersecurity CIP code is identified as a Technology program an additional \$10,000 is generated per graduate.

Showcase Labs

Needed to Grow All Business Programs



CURRENT LAB



IMAGINED LABS
@ Both Campuses



DISCUSSION

Agenda Item 4.5

Employment Searches Report

Background

During the 2017-18 Academic Year the university established 11 strands of work within its Short-Term Action Plan. Goal #3 Grow Student and Campus Diversity: “Elevate Oregon Tech’s commitment to nurture our environment of diversity and inclusion, by pursuing multiple modalities to celebrate and strengthen diversity among faculty, staff and students.” In pursuit of this goal the university has begun to more systematically focus on recruiting and retaining not only a diverse student body but diverse faculty and staff.

Thanks to the significant effort of our academic departments, deans and provost 22 of 23 (95%) of all faculty searches during the 2017-18 Academic Year came to a successful completion. This is much higher than previous years’ success rate. During that process Human Resources implemented a new software based search and hiring process. As a part of this process HR ensured that past and new efforts including; veteran’s preference, advertising through Workforce Oregon, diversity of search committees, training of search chairs, and ongoing reviews of internal hires and direct appointments with regard to diversity continue or are strengthened. In both faculty and staff searches HR trains search committee chairs on the university’s diversity goals and obligations under EEOC requirements. These initiatives continue to be refined, and HR, in conjunction with Academic Affairs is committed to identifying additional strategies to further increase diversity, in all its forms, on campus.

Attached to this report are several data sets which provide background information on Klamath Falls and the Portland-Metro area regarding racial and ethnic diversity. Following this information are the current demographics of employees at Oregon Tech and the racial, ethnic and gender diversity of faculty and staff search applicant pools and hires. It is recognized that developing a diverse candidate pool at the university’s primary location can, at times, be challenging and must be a long-term initiative of the university.

Staff Recommendation

No action necessary, for discussion purposes only.

Attachments

- Census Profiles
- Oregon Tech Employee Diversity Report
- Oregon Tech Workforce Diversity Report

2000 and 2010 Census Profile

Klamath Falls city

POPULATION (continued)	2000		2010		Change	
RACE						
Total population	19,462	100.0%	20,840	100.0%	1,378	7.1%
White alone	16,566	85.1%	17,380	83.4%	814	4.9%
Black or African American alone	198	1.0%	215	1.0%	17	8.6%
American Indian and Alaska Native alone	864	4.4%	897	4.3%	33	3.8%
Asian alone	256	1.3%	340	1.6%	84	32.8%
Native Hawaiian and Other Pacific Islander alone	26	0.1%	24	0.1%	-2	-7.7%
Some Other Race alone	807	4.1%	934	4.5%	127	15.7%
Two or More Races	745	3.8%	1,050	5.0%	305	40.9%

Sources: U.S. Census Bureau, 2010 Census, Summary File 1; 2000 Census, Summary File 1.

Tabulated by Population Research Center, Portland State University.

www.pdx.edu/prc

2000 and 2010 Census Profile

Portland-Vancouver-Hillsboro MSA

POPULATION (continued)	2000		2010		Change	
RACE						
Total population	1,927,881	100.0%	2,226,009	100.0%	298,128	15.5%
White alone	1,630,183	84.6%	1,803,705	81.0%	173,522	10.6%
Black or African American alone	51,455	2.7%	63,650	2.9%	12,195	23.7%
American Indian and Alaska Native alone	17,074	0.9%	20,857	0.9%	3,783	22.2%
Asian alone	87,993	4.6%	126,965	5.7%	38,972	44.3%
Native Hawaiian and Other Pacific Islander alone	5,652	0.3%	10,315	0.5%	4,663	82.5%
Some Other Race alone	72,181	3.7%	109,776	4.9%	37,595	52.1%
Two or More Races	63,343	3.3%	90,741	4.1%	27,398	43.3%

Sources: U.S. Census Bureau, 2010 Census, Summary File 1; 2000 Census, Summary File 1.

Tabulated by Population Research Center, Portland State University.

www.pdx.edu/prc

2000 and 2010 Census Profile

State of Oregon

POPULATION (continued)	2000		2010		Change	
RACE						
Total population	3,421,399	100.0%	3,831,074	100.0%	409,675	12.0%
White alone	2,961,623	86.6%	3,204,614	83.6%	242,991	8.2%
Black or African American alone	55,662	1.6%	69,206	1.8%	13,544	24.3%
American Indian and Alaska Native alone	45,211	1.3%	53,203	1.4%	7,992	17.7%
Asian alone	101,350	3.0%	141,263	3.7%	39,913	39.4%
Native Hawaiian and Other Pacific Islander alone	7,976	0.2%	13,404	0.3%	5,428	68.1%
Some Other Race alone	144,832	4.2%	204,625	5.3%	59,793	41.3%
Two or More Races	104,745	3.1%	144,759	3.8%	40,014	38.2%

Sources: U.S. Census Bureau, 2010 Census, Summary File 1; 2000 Census, Summary File 1.

Tabulated by Population Research Center, Portland State University.

www.pdx.edu/prc

OREGON TECH EMPLOYEE DIVERSITY REPORT

OCTOBER 31, 2018

Race	Total	%
American Indian or Alaska Native	11	2.41%
Asian	26	5.69%
Black or African American	6	1.31%
Declined to Respond	5	1.09%
Hispanic or Latino	23	5.03%
Multiple Races	9	1.97%
Native Hawaiian or Other Pacific Islander	1	0.22%
Other - Unknown	1	0.22%
Unknown	1	0.22%
White	374	81.84%
Grand Total	457	100.00%

Ethnicity	Total	%
Hispanic or Latino	23	5.03%
Declined to Respond	7	1.53%
Not Hispanic or Latino	427	93.44%
Grand Total	457	100.00%

Age Range	Total	%
20-30	34	7.44%
31-40	122	26.70%
41-50	115	25.16%
51-60	132	28.88%
61 & up	54	11.82%
Grand Total	457	100.00%

Gender	Total	%
Female	237	51.86%
Male	220	48.14%
Grand Total	457	100.00%

All data was self reported by the employee

Data as of October 31, 2018

"Declined" indicates that employee did not disclose Race or Gender

OREGON TECH WORKFORCE DIVERSITY REPORT OCTOBER 2017 – OCTOBER 2018

Faculty Applicants by Race	Count	Percentage
American Indian	8	1.48%
Asian	174	32.28%
Black or African American	12	2.23%
Native Hawaiian or Other Pacific Islander	0	0.00%
White	297	55.10%
Decline	48	8.91%
Grand Total	539	100.00%

Staff Applicants by Race	Count	Percentage
American Indian or Alaska Native	46	3.06%
Asian	61	4.06%
Black or African American	51	3.39%
Native Hawaiian or Other Pacific Islander	24	1.60%
White	1209	80.39%
Decline	113	7.51%
Grand Total	1504	100.00%

Faculty Applicants by Gender	Count	Percentage
Female	124	23.01%
Male	376	69.76%
Other	0	0.00%
Declined	39	7.24%
Grand Total	539	100.00%

Staff Applicants by Gender	Count	Percentage
Female	788	52.39%
Male	652	43.35%
Other	8	0.53%
Declined	56	3.72%
Grand Total	1504	100.00%

Filled Faculty Postings by Race	Count	Percentage
American Indian or Alaska Native	0	0.00%
Asian	3	13.04%
Black or African American	0	0.00%
White	17	73.91%
Declined	3	13.04%
Grand Total	23	100.00%

Filled Staff Postings by Race	Count	Percentage
American Indian or Alaska Native	3	5.26%
Asian	1	1.75%
Black or African American	1	1.75%
White	52	91.23%
Declined	0	0.00%
Grand Total	57	100.00%

Filled Faculty Postings by Gender	Count	Percentage
Female	10	43.48%
Male	12	52.17%
Declined	1	4.35%
Grand Total	23	100.00%

Filled Staff Postings by Gender	Count	Percentage
Female	34	59.65%
Male	23	40.35%
Declined	0	0.00%
Grand Total	57	100.00%

All data was self reported by applicant

Data as of 10/1/2017 through 10/16/2018

"Declined" indicates that applicant did not disclose Race or Gender

DISCUSSION

Agenda Item 4.6

Career Services Presentation

Background

Jennifer Kass, Director of Career Services, will give a presentation on Oregon Tech's Career Services.

Recommendation

None. Item is informational only.

Attachments

PowerPoint Presentation

Career Services 101



LINKEDIN NETWORKING
RESUMES JOB SEARCH
CAREER FAIRS
INTERVIEWS CAREER
INTERNSHIPS INDECISION
COVER LETTERS

Jennifer Kass, Director of Career Services

Our Team

...is lean and agile!



Jennifer Kass, MBA, MA - Director



New!
Lynde Wright - Employer Relations



Sarah Moore, M.Ed - Asst Director



Crystal Munro - Specialist
(DHS contract)

Our Mission

...informs everything we do



Empower

Work with others across the university to equip all Oregon Tech students and alumni with the skills needed to advance in their careers, now and in the future



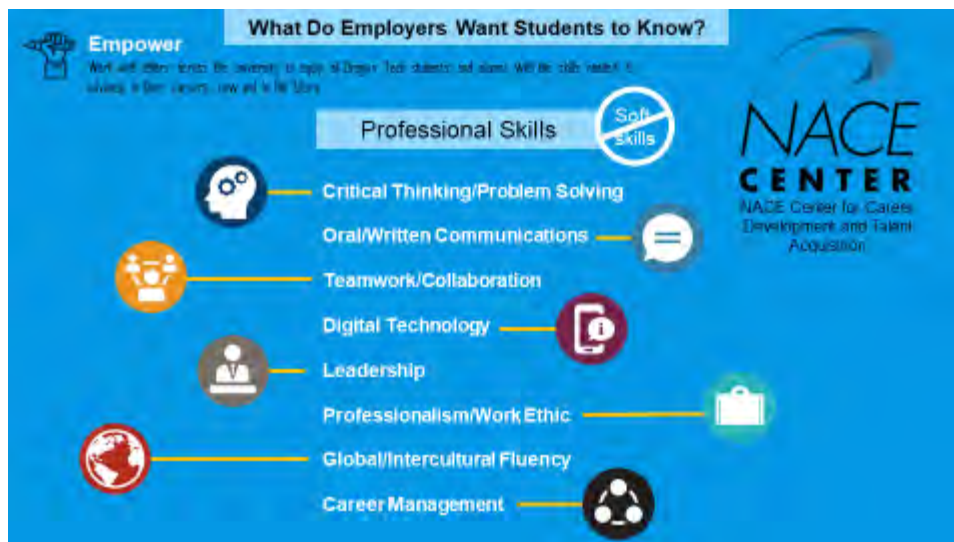
Educate

Teach students and alumni how to find and take advantage of opportunities that are the best fit with their interests, skills and career goals



Enhance

Increase the number and quality of opportunities students can access





Educate

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How Do We Educate?



Enhance **Helping Students to Make Connections**
Increase the number and quality of opportunities students can access

Talent, meet opportunity.

Handshake helps students - **all students** - find meaningful careers.

Handshake is transforming college recruiting for...

9 million+ Students & Young Alumni <i>Accounting to 2020</i>	500+ University Career Centers <i>Big State to Liberal Arts</i>	250,000+ Employers <i>Private, 501(c)(3) Non-Profit</i>
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Enhance **Helping Students to Make Connections**

Handshake = Hundreds of Jobs Relevant to Students

...local, national, and international

Office Assistant – Educational Partnerships and Outreach-WLV Oregon Tech Student Employment	Mickey Leland Energy Fellowship (MLEF) Program U.S. Department of Energy
Navy Supply Officer Navy Talent Acquisition Group Portland	OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION Research Experiences and Internships at the National Energy Technology Laboratory <i>Challenging community to science and education</i>
Regional Medical Laboratory Scientist U.S. Department of State	Junior Engineer with City of Klamath Falls Oregon Employment Department
Community Operations Specialist Facebook	Software Developer Corporate Recruiting Solutions Portland, Oregon/United States

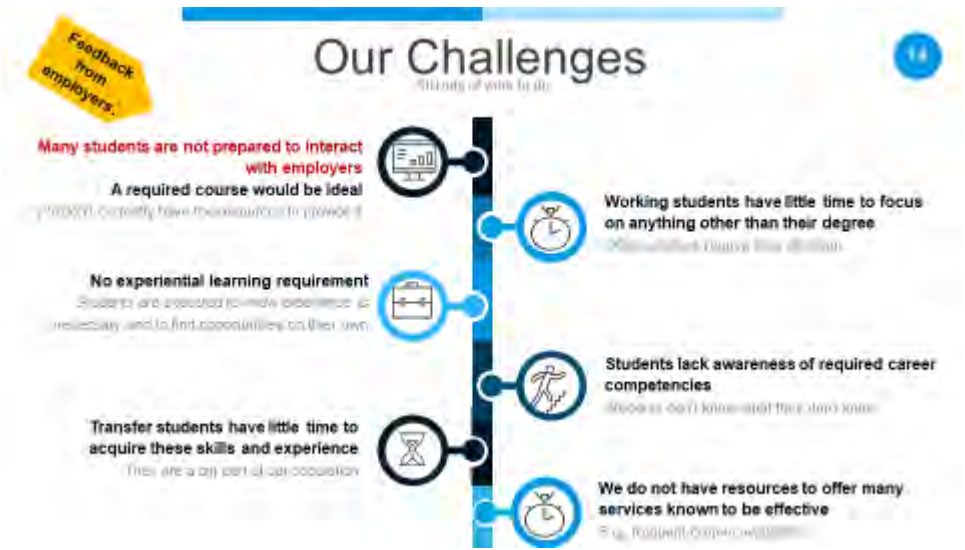


Klamath Falls Career Fairs



Portland Metro Career Fairs





Thank You!

Questions?

NACE Center for Career Development and Talent Acquisition – Career Competency Definitions

Critical Thinking/Problem Solving: Exercise sound reasoning to analyze issues, make decisions, and overcome problems. The individual is able to obtain, interpret, and use knowledge, facts, and data in this process, and may demonstrate originality and inventiveness.

Oral/Written Communications: Articulate thoughts and ideas clearly and effectively in written and oral forms to persons inside and outside of the organization. The individual has public speaking skills; is able to express ideas to others; and can write/edit memos, letters, and complex technical reports clearly and effectively.

Teamwork/Collaboration: Build collaborative relationships with colleagues and customers representing diverse cultures, races, ages, genders, religions, lifestyles, and viewpoints. The individual is able to work within a team structure, and can negotiate and manage conflict.

Digital Technology: Leverage existing digital technologies ethically and efficiently to solve problems, complete tasks, and accomplish goals. The individual demonstrates effective adaptability to new and emerging technologies.

Leadership: Leverage the strengths of others to achieve common goals, and use interpersonal skills to coach and develop others. The individual is able to assess and manage his/her emotions and those of others; use empathetic skills to guide and motivate; and organize, prioritize, and delegate work.

Professionalism/Work Ethic: Demonstrate personal accountability and effective work habits, e.g., punctuality, working productively with others, and time workload management, and understand the impact of non-verbal communication on professional work image. The individual demonstrates integrity and ethical behavior, acts responsibly with the interests of the larger community in mind, and is able to learn from his/her mistakes.

Career Management: Identify and articulate one's skills, strengths, knowledge, and experiences relevant to the position desired and career goals, and identify areas necessary for professional growth. The individual is able to navigate and explore job options, understands and can take the steps necessary to pursue opportunities, and understands how to self-advocate for opportunities in the workplace.

Global/Intercultural Fluency: Value, respect, and learn from diverse cultures, races, ages, genders, sexual orientations, and religions. The individual demonstrates openness, inclusiveness, sensitivity, and the ability to interact respectfully with all people and understand individuals' differences.