Outcomes and Data

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Wayne State University

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University of North Carolina- Chapel Hill

Stephanie Watts, PhD
Michigan State University

Cynthia Fuhrmann, PhD
University of Massachusetts Medical School
Importance of Data

Measuring Impact of Doctoral Program Outcomes on Student Success
Why is it important to collect and report data through the continuum of training and beyond?

- Data collection and tracking is required from application through alumni career outcomes
- Data are critical to strategic planning and outcomes assessment for all graduate and postgraduate programs institutionally
- Data are crucial to ensure faculty buy-in
- Data collected at individual institutions and aggregated and reported nationally form the basis for comparisons and for informing national policies that influence graduate and postdoctoral training across the nation and demonstrate the great economic impact in the scientific research enterprise of the country
Barriers to Data Collection, Reporting and Aggregation

- Institutional barriers
- National barriers
Institutional Barriers

- Data silos make it difficult to address questions critical to strategic planning and outcomes assessment
- Data, if at all collected, are located all over campus and vary in completeness and “cleanliness”
- Lag between activity and outcomes results in lost data
First step

Understanding and cleaning up institutional data silos
The Jigsaw Puzzle that is the current status of institutional data silos

- Prior Academic History (Admissions Office)
- Student Performance Indicators (Registrar’s Office)
- Research Productivity (Research Office)
- Financial Support, Fellowships (HR System)
- Professional Development (Department Spreadsheet)
- Alumni Employment Outcomes (Alumni Affairs or not captured)
The scattered jigsaw pieces make it difficult to utilize data to make informed decisions

- When data reside in different silos, it is difficult to bring the pieces together to convince faculty, for example, for the need to make informed decisions about the need for professional development for their trainees

OR

- Lacking good data makes it difficult to make comparisons across graduate departments to allocate graduate assistantships and financial packages
Example—Faculty buy-in related to PD activities:

- Does participation in professional development activities as a graduate student or post-doctoral trainee impact research performance or time to degree and does it affect long-term employment outcomes?
Example—Resource allocation toward fellowships:

- Does support on competitive fellowships produce better employment outcomes or does it simply select top students who would have succeeded regardless of support?
Fitting together the pieces of the jigsaw puzzle knocks down the silos and provide the complete picture of student and program performance.

Holistic perspective helps to make decisions in a meaningful informed way in which there is complete transparency.
Holistic Perspective on Student Data

Student Centered Data System
(Aggregation Site)

- Research Productivity (Not typically captured)
- Alumni Employment Outcomes (Alumni Affairs or not captured)
- Prior Academic History (Admissions System)
- Financial Support, Fellowships (HR System)
- Student Performance Indicators (Student Info System)
- Professional Development (Not typically captured)

Analytics
Recruitment
Assessment
Academic Program Review
Funding Allocations
Professional Development
New Programs
Advancement
LBB

(Life Before BEST)

What we did at Wayne State University before the BEST award
So now we have institutional data

But how do we compare nationally?

What is the collective impact of all our doctoral outcomes nationally?

Remember, our PhD alum is your future trainee/employee (i.e. your database)
But each institution has their own data collection, taxonomy and data visualization.

So how do we compare and aggregate data across institutions, in order to have a collective national impact?
National *efforts* to data reporting, comparison and aggregation

Multiple efforts, but were they also leading to “organized chaos”

- BEST
- GREAT
- FOBGAPT
- RBR
- CGS

We need to integrate these efforts into one collective and produce an agreed upon taxonomy to advance a single national product that can be used by all institutions so that the biomedical training community can provide the best skills training for the 21st century careers and demonstrate the scientific, labor and economic impact nationally and across the globe of the biomedical workforce
Second step

*Developing common taxonomy for data collection, reporting and standards*

- Employment Sector
- Career Type
- Job Function
Good News!

All the groups (BEST and non-BEST) worked together to create a unified Career Outcomes Taxonomy!!!!!!!

Please view our poster on Friday:
Stayart et al. “Constructing a Taxonomy for Career Outcome Reporting”
SECTOR

Academia
Government
For-Profit
Nonprofit
Other
CAREER TYPE

- Primarily Research
- Primarily Teaching
- Science-related
- Not-related to science
- Further training or education
Administration
Business Development, Consulting, and Strategic Alliances
Clinical Research Management
Clinical Services
Data Science, Analytics, and Software Engineering
Entrepreneurship
Faculty: nontenure track
Faculty: tenured/tenure track
Faculty: track unclear or not applicable
Full-time Teaching Staff/Instructor
Group Leader (research)
Healthcare Provider
Intellectual Property and Law
Part-time Teaching Staff/Adjunct
Postdoctoral Research
Regulatory Affairs
Research Staff or Technical Director
Sales and Marketing
Science Education and Outreach
Science Policy and Government Affairs
Science Writing and Communication
Technical Support and Product Development
Completing further education or training
Other
Deceased/retired
Goals of this Session

In this session we will discuss:

- Data Visualization using the Common Taxonomy
  *Wayne State University*

- Data Usage and Tracking
  *University of North Carolina Chapel Hill*

- Data Inventory Tools
  *Michigan State University*

- Data Usage for Programs and Professional Development
  *University of Massachusetts Medical School*
Data presentation, visualization using the Common Taxonomy
BEST@Wayne

Ambika Mathur, PI
Christine Chow, co-PI
Heidi Kenaga, Program Manager
Andrew Feig
Janice Green
Judith Moldenhauer
Mathew Ouellett
Mustafa Ziyad
Biomedical Science PhD Career outcomes 0-15 years following graduation
Employment Sector (N=1027)

Academia: 532
For-Profit: 322
Government: 52
Nonprofit: 37
Other: 6

*Unknown (N=78) 7.59%
Biomedical Science PhD Career outcomes 0-15 years following graduation
(Employment Sector)
Biomedical Science PhD Career outcomes 0-15 years following graduation Employment Sector (N=1027)

- **0-5 years** (N = 254)
  - Academia: 159
  - For-Profit: 65
  - Government: 10
  - Nonprofit: 5
  - Other: 2

  *Unknown (N=13) 5.12%

- **6-10 years** (N = 368)
  - Academia: 200
  - For-Profit: 108
  - Government: 23
  - Nonprofit: 19
  - Other: 1

  *Unknown (N=17) 4.62%

- **11-15 years** (N = 405)
  - Academia: 173
  - For-Profit: 149
  - Government: 19
  - Nonprofit: 13
  - Other: 3

  *Unknown (N=48) 11.85%

- **All: 0-15 years** (N = 1027)
  - Academia: 532
  - For-Profit: 322
  - Government: 52
  - Nonprofit: 37
  - Other: 6

  *Unknown (N=78) 7.59%
Biomedical Science PhD Career outcomes 0-15 years following graduation

(Career Type)

- Primarily Research: 449
- Science-Related: 250
- Primarily Teaching: 134
- Not Related to Science: 66
Biomedical Science PhD Career outcomes 0-15 years following graduation
Job Function (N = 1027)

2000-2014

*Unknown (N=153) 14.90%
Biomedical Science PhD Career outcomes 0-15 years following graduation
Job Function (N=1027)

0-5 years (N=254)

5.00% 10.00% 15.00% 20.00% 25.00% 30.00% 35.00%

Adjunct Administration Business Clinical Data Science/Research Entrepreneurs Faculty Group Leader Healthcare Intellectual Lecturer/Instr Postdoctoral Regulatory Research Staff Sales and Science Technical

6-10 years (N=368)

5.00% 10.00% 15.00% 20.00% 25.00% 30.00% 35.00%

Adjunct Administration Business Clinical Clinical Services Data Science/Research Entrepreneurs Faculty Group Leader Healthcare Intellectual Lecturer/Instr Postdoctoral Regulatory Research Staff Sales and Science Technical

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All: 0-15 years (N=1027)

5.00% 10.00% 15.00% 20.00% 25.00% 30.00% 35.00%

Adjunct Administration Business Clinical Data Science/Research Entrepreneurs Faculty Group Leader Healthcare Intellectual Lecturer/Instr Postdoctoral Regulatory Research Staff Sales and Science Technical

*Unknown(N=28) 11.02%
*Unknown(N=70) 17.28%
*Unknown(N=55) 14.95%
*Unknown(N=153) 14.90%
Biomedical Science PhD Career outcomes 0-15 years following graduation (N=1027)
These data underscore the importance of having common taxonomy for employment sectors, job titles and job functions!

Especially as we move towards aggregating data nationally!
University of North Carolina Chapel Hill
Patrick Brandt

UNC BEST
Data Usage and Tracking
Patrick Brandt, PhD, Co-PI ImPACT Program, ImPACT Internship Director

Beka Layton, PhD, Director of TIBBS

Patrick Brennwald PhD Professor, PI ImPACT Program

Jean Cook, PhD, Professor & Associate Dean, Co-PI ImPACT Program
HOW UNC USES PROGRAM GATHERED DATA

- **Data we collect**
  - Attendance records
  - Qualitative evaluation data
    - Focus group surveys (e.g., External Evaluator)
  - Quantitative evaluation data
  - Surveys
    - Program Evaluation (e.g., annual, event-specific)
    - Entrance and Exit surveys for grad students and postdocs
    - Pre and post internship surveys

- **Outcomes we measure**
  - Time to degree, productivity (pubs), fellowships
  - Career Placement & Job Satisfaction
CHALLENGES OF PROGRAM GATHERED DATA TRACKING

- Program and University level data challenges
  - Data Centralization/Collection
  - Merging Departmental/Graduate education data
  - Database choice (Excel, Access, RedCap)
  - Alumni Outcome Update Frequency – every two years

- Tracking attendance (staff)
  - Methods (e.g., Event registration; Sign-in sheets)
  - Purpose: Outcome evaluation
1. Students [are] acutely aware that very few of them are going to end up in academia. And so I think it doesn't hurt to give them some options and say, "Look, we just want you to be a success and there's light at the end of the tunnel.

2. I think having a month of industry experience in a CV for someone who has nothing ... is actually a hugely important step.

3. The reason that I'm so supportive of my people doing [a short internship] is that it offers a distinct part of their training than what I can offer and I feel like I'm obligated as their advisor to prepare them ... for as many options as possible.

4. [My trainee returned more] on-track and ... really excited about the options. So that's good for morale for the whole lab. I see it as a benefit.
BEST Intern Focus Group Quotes

1. I went into this internship thinking I wanted to do bench research in an industry setting, but I came into a company at the point when they were getting ready to launch a product and so I got to see; what the milestones were, how strategic decisions happen in that space, and because of the networking that my mentor was able to set me up with, I was able to talk with all the engineers and strategists on the product development team and realize that that was an area that I was really interested in.

2. Part of the reason I wanted to do [the internship] was to see if I would actually really like a career [in this field], and so I think the best thing for me was to see that like yes, this would work, like I can do this, I like it, I'm good at it. And so it was just sort of testing it out and that was really useful.

3. I introduced my current PI with the supervisor that I had when I worked at [the internship site] and they're now writing a grant together.
UNC Trainees’ Career Interests

% of Respondents Considering Career Track

- Industry research
- Government research
- Translational medicine
- Tenure-track academia
- Scientific consulting
- Science outreach
- Teaching Intensive career
- Science policy
- Science writing/editing
- Science administration
- Regulatory affairs
- Intellectual Property
- Undecided
- Other

OUTCOME TRACKING

- Tenure Track PI, Teaching Intensive Careers, Research Track
- Academia (31%)
- Industry Research (28%)
- Industry Business Dev. (17%)
- Gov't Non-Profit Res. (8%)
- Gov't Non-res. (6%)
- Sci Writing (6%)
- Other (4%)
- PI or Staff Scientist at NIH
- Entrepreneur/CEO, Consulting, IP/Tech Transfer, Manager/Director, MSL
- NIH Grant Manager, Regulatory Affairs, Science Policy, Outreach

Big Pharma R&D, Biotech/Start-Up, Contract Research
DOES PARTICIPATION IN CAREER EVENTS DELAY GRADUATION?

* 2-tailed T test

Number of Events Attended

<table>
<thead>
<tr>
<th>Number of Events</th>
<th>Years to PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (n=78)</td>
<td>6</td>
</tr>
<tr>
<td>1-3 (n=77)</td>
<td>6</td>
</tr>
<tr>
<td>4+ (n=43)</td>
<td>6</td>
</tr>
</tbody>
</table>

* p = .015
* p = .045
DO INTERNSHIPS AFFECT TIME TO DEGREE?

p = 0.059

* 2-tailed T test
DO INTERNSHIPS AFFECT PUBLICATION RATE?

Number of Publications

<table>
<thead>
<tr>
<th></th>
<th>All Grad Students</th>
<th>Interns</th>
<th>N=127</th>
<th>N=23</th>
<th>p=0.84</th>
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</thead>
<tbody>
<tr>
<td>First Author Publications</td>
<td>N=127</td>
<td>N=23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Publications</td>
<td>N=127</td>
<td>N=23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p=0.66
Michigan State University
Stephanie Watts

BEST Action Inventory Tool
MSU BEST: BEST Action Inventory Tool (BAI)

Stephanie W Watts
wattss@msu.edu
Trainee
Guided by parallel mentoring in discipline and in career opportunities.

Mentor
Guidance in discipline of choice and also insight and assistance in helping trainee find a satisfying biomedical career.

Career Consultant
Guidance for choices in Careers that build from a PhD in Biomedical Science.
DATA- Creation of BAI!

• Creation of BEST Action Inventory Tool (BAI)
  - helps trainees keep track of what they’ve done
    • activity
    • time
    • frequency
  - lets mentors add in their ‘touches’
  - lets externship provides add in their input

• Allows us to capture a dose of BEST and reflect this back onto the survey findings; report

Jump into BAI here
Think of this also as a Career Development Log for your trainees that they can show as evidence of commitment to career development.
We are scientists
and this is a grand experiment

How can we work together
to test this out? Spread
Good practices?
Sharing data: The many ways data can benefit your program and the field of PhD career dev’pt

Cynthia Fuhrmann, PhD (presenter)
Phil Zamore, PhD
Morgan Thompson, PhD
Mary Ellen Lane, PhD
David Weaver, PhD
Tony Imbalzano, PhD
Sonia Hall, PhD

External evaluation:
Laura O’Dwyer, PhD
Katherine Shields, PhD
Avery Newton

@GSBScareer
@UMassMedical
Our approach: Career development integrated into the required PhD curriculum

<table>
<thead>
<tr>
<th>Planning for Career, Research</th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Fourth and Later Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choosing lab, career exposure</td>
<td></td>
<td></td>
<td>IDP</td>
<td></td>
</tr>
<tr>
<td>TRAC (thesis committee) meetings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leadership, interpersonal communication</th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Fourth and Later Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transitioning into thesis lab</td>
<td></td>
<td></td>
<td></td>
<td>Supervising/mentoring</td>
</tr>
<tr>
<td>Seeking &amp; communicating w/mentors</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Writing</th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Fourth and Later Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fellowship applications, qual proposals</td>
<td></td>
<td></td>
<td></td>
<td>Scientific manuscript</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Presentation</th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Fourth and Later Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class presentations, rotation reports</td>
<td></td>
<td></td>
<td></td>
<td>Dept’l talks, conferences</td>
</tr>
<tr>
<td>Qual exam</td>
<td></td>
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</tbody>
</table>

- Required lesson (typically 2 hours)
- Career Pathways Community
- Under consideration

Workshops and activities designed to be time-efficient, spread across years of training. Skills taught just-in-time and in the context of their existing coursework & thesis research.
Types of data we collect

Surveys (pre, post, annual)
- Students, postdocs, faculty; alumni
Focus groups
Lesson evaluations
Event attendance
Time to degree, # pubs, etc.
Alumni career outcomes

Adapt our approach
Inform our community
Share with the field of PhD career development
Example outcomes we are measuring

- Knowledge of career options
- Career interests
- Attitudes & beliefs impacting career development
- Planning for career goals
- Types of mentors, frequency of discussions, topics discussed
- Actions taken to support career development (by mentor, mentee)
- Social cognitive career theory measures: self-efficacy, goals, & outcome expectations
- Efficiency in attaining career goals; satisfaction with career
- Research productivity
- Satisfaction with institutional support for career development
Goal for this talk

Provide examples from our own experience to prompt your consideration of:

• Why are you collecting data? How will you use it?
• What data is most important for you to collect?
• Who will you share your data with?
• How will you display the data? What context will you provide?
Data use #1: Reaching student learning outcomes

Example UMMS uses: recruitment weekend, orientation week, courses, workshops

What career paths have alumni entered?
Current position in 2014 (10 or more yrs post-Ph.D.)

- Faculty: research or research/teaching: 24%
- Research in industry: 24%
- Faculty: Teaching: 25%
- Research staff in Academia/govt: 10%
- Not categorized: 6%
- Health care, Leadership in industry, Business of sci, Reg affairs, IP law: 4%
- Sci writing, Sci policy, Etc.: 7%

S. Foley, A. Imbalzano, UMass Med GSBS 2014

Alumni career outcome data
Data use #2: Reaching campus learning outcomes

Example UMMS uses: Research retreat, social media, teasers before events, departmental presentations

94% of GSBS faculty have one or more friends/colleagues who pursued science careers in non-academic settings.

95% of these respondents (n=122) are comfortable referring advisees to them for career advice.
Data use #3:
Maximize transparency and trust

*Example UMMS use: Sharing workshop/course evaluation reports with…*

- Graduate Assembly (representing graduate program faculty and trainees)
- Training grant leadership
- Departmental meetings
Evaluation report:
Displaying quantitative data

Overall, this lesson was valuable.

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Strongly agree</th>
<th>Strongly disagree</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson 1</td>
<td>7</td>
<td>2</td>
<td>5.8</td>
</tr>
<tr>
<td>Lesson 2</td>
<td>6</td>
<td>3</td>
<td>6.3</td>
</tr>
<tr>
<td>Lesson 3</td>
<td>5</td>
<td>4</td>
<td>6.6</td>
</tr>
<tr>
<td>Lesson 4</td>
<td>4</td>
<td>5</td>
<td>5.8</td>
</tr>
<tr>
<td>Lesson 5</td>
<td>3</td>
<td>6</td>
<td>5.4</td>
</tr>
</tbody>
</table>

Evaluation data (gathered on paper at end of lesson/course)
Evaluation report:
Displaying quantitative data

Overall, this lesson was valuable.

<table>
<thead>
<tr>
<th>Lesson</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>19</td>
<td>23</td>
<td>21</td>
<td>16</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>0.7</td>
<td>1.3</td>
<td>1.6</td>
<td>0.9</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Response rate</td>
<td>54%</td>
<td>72%</td>
<td>65%</td>
<td>47%</td>
<td>50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Overall, this lesson (series) was valuable. (1-7 Likert scale)

About graph: Black lines denote average and standard deviation. Each grey dot represents a response in the jittered scatter plot.

Jitter plot, by M. Thompson
Evaluation report: Displaying qualitative data

What did you like most about this lesson? (40 students provided a comment)
Examples and demonstrations to dissect (9), interactive exercises (9), tips for delivery developing slides (5), that strategies taught were specific not general/vague (4)

“I liked how in depth was the teaching on things that we never think about like to talk/slide; but which are very important for graduate training.”
“Video example and involvement of the whole class. Breathing exercise was good.”
“Watching examples of slides and presentations to see strengths and weaknesses.”
“Very informative. Things I never thought about.”
“Collaborating on a PowerPoint with other students revealed multiple approaches to the same problem.”
“It wasn’t so general, scientific examples were useful.”
“Constructive tips and interactive environment.”
How could today’s lesson be improved? (31 students made a suggestion)
 Allow more time for slide exercise (14), more interactive exercises or feedback, tips on slide or figure design (3)

“More clear in directions. Group activity was a little short to get any
Do more small group activities to keep us engaged and to allow us teaching us in a constructive supportive environment.”
“The slide prep exercise was rushed and it was really hard to design was sort of a too many cooks situation.”

Identify common themes, code all comments, provide example comments
Data use #4: Summarizing overall program

Example UMMS use: Brochure to share with faculty, advisory boards, donors

Additional Offerings For All Students And Postdocs

The Center for Biomedical Career Development offers a number of events and services to graduate students and postdoctoral trainees every year to take advantage of in their own need arises.

ACADEMIC JOB SEARCH SERIES

For students preparing future careers in faculty, we offer an annual four-week job search series. The workshops cover strategies for navigating an academic job search, preparing application materials, and writing, interviewing, and obtaining a startup package. Because many PhDs trainees expect undergraduate teaching opportunities, we developed a partnership with Becker College to offer a short on-campus course on how to teach effectively. Non-teaching faculty members are also taught on how to develop a statement of teaching philosophy.

"The Academic Job Search series dramatically increased my confidence in entering the academic job market. These workshops answer questions that either seem too peripheral to ask your own faculty mentor, or which the faculty mentor might not know the answer (e.g. What goes into a teaching statement?). It is also a great way to meet peers going through the process." - postdoc

UMMS | CENTER FOR BIOMEDICAL CAREER DEVELOPMENT

CAREER EXPOSURE EVENTS

In annual surveys, students self-assess that they have low knowledge of a variety of careers outside of academic research. In light of career paths they are currently considering. We have therefore been to increase exposure to a variety of career paths and careers for scientists. We have done so through Careers for PhDs events (career panel, followed by small group discussions) and Career Clans (small group discussion with a single PhD awaiting). To do deeper, UMMS provides not advanced graduate students, we invited to apply to participate in Career Pathways Communities. We also advise and support student-postdoctoral organizations leading career exposure events, such as site visits and alumni career networking events.

UMMS | CENTER FOR BIOMEDICAL CAREER DEVELOPMENT

Additional Offerings • Summer 2017

SUMMER 2017 • ADDITIONAL OFFERINGS | 11

Brochure created by Sonia Hall
Data use #4: Summarizing overall program

Example UMMS use: Brochure to share with faculty, advisory boards, donors
Data use #5: Sharing data to advance the field of PhD career development

• Presentations at conferences, other institutions (AAMC GREAT, GCC, NPA, etc.)

• Publications
  – Describing educational approach
    • Inside Higher Ed, Chronicle of Higher Education
    • Peer-reviewed journals (editorial, commentary)

  – Evaluative and research studies in peer-reviewed journals
    • Science journals
    • Science education journals (CBE-LSE, JMBE, BAMBED, Academic Medicine)
DISCUSSION

We want to know about efforts at your institutions in these areas!