Writing Scientist Biographies Increases Student’s Awareness of Diversity in Genetics

Jennifer Robison¹, Nicolas Berbari², Anusha Rao³
¹Manchester University Department of Biology
²IUPUI Department of Biology, ³IUPUI Center for Teaching and Learning

Project Motivation
- Inclusive pedagogy is the purposeful design of a learning environment so that all students feel equally welcomed and included.
- Inclusive pedagogy uses dynamic practices, varied assessments, and integration of multicultural content.
- Students that feel excluded struggle to learn compared to those that feel included (Hurtado et al., 1999. Higher Education Report 26).
- Society still visualizes scientists as the stereotypical Caucasian male in white lab coat.
- Lack of representation makes it difficult for other demographics to fully engage as they lack role models in STEM (Tanner & Allen, 2007. CBE Life Sciences Education 6:251-258).

Study Hypotheses
- Adding multicultural content to a genetics lab course...
  - will increase student’s awareness and appreciation of diversity in the field of genetics.
  - may provide important science role models for students
- Using contemporary geneticists will increase awareness of current avenues of research
- Writing for a lay audience will increase understanding of genetic concepts and terminology

Student Learning Objectives
- Students will explain complicated genetic research to a lay audience in the form of a magazine article
- Students will evaluate and categorize scientist biography articles to create a Table of Contents

The Intervention
- A pre- and post-test asking students to list all the geneticists they know and what that geneticists contribution was to the field
- Creating a Mock Magazine
  Part I: Compose a 500 word biography of a randomly assigned geneticist comprised of ~ 50/50 research/personal details

The Scientists
Aaron Ciechanover
Alexander Stark
Anand Chakravarti
Ben Barnes
Bruce Lahn
Cassandra Estes
Craig Poidland
David M Kingsley
Erika De Sombre
Elizabeth Blackburn
Guilherme Freitas
Harold Varmus
Heidi Reisman
Herman Muller
Jean-Baptiste Lamark
Johannes Meier
Karen Braren
Karen Davis
Kary Mullis
Kevin Plaxco
Kevin P. Mankala
Lynn Margulis
Marcia Mann
Mary-Claire King
Melvin C. King
Michael Taylor
Michael Viti
Nicolas Berbari
Ozato
Richard R. Roberts
Richard N. Zare
Robte Smulski
Shirley Tilghman
Shirley Pfannenstiel
Steven L. Swallow
Stephen C. Harrison
Terri E. Spring
Thomas Cech
Vinceg Pirozza
Vinceg Pirozza
Vincent Vitetta
Vincent S. Mazaro
Vincent S. Mazaro
Vivian F. Pires
Vivian F. Pires
Wardell Ponder
Wardell Ponder
Wallace F. Broberg
William H. Brimley
William H. Brimley
Winston R. Price
Winston R. Price
Xiaoy Wang
Xiaoy Wang
Yuan Q. Chau
Yuan Q. Chau
Yusuke Ohno
Yusuke Ohno
Zong Han
Zong Han
Zong Han
Zong Han
Zong Han
Zong Han
Zong Han
Zong Han

Conclusions and Future Work
- Overall, this intervention increased student’s awareness and appreciation of the diverse and multicultural nature of the population working in the field of genetics.
- Instructor observations included:
  - Students reported feeling less intimidated by science as many of the biographies highlighted obstacles overcome by the scientist.
  - Students noted in post-test that while they could remember the research, they had trouble remembering the names as they were “so different.”
  - Qualitative analysis of scientist biographies written by the student is being performed to identify any patterns or implicit biases present.
  - This intervention may provide role models for students that may otherwise feel excluded in curriculum, particularly in laboratory courses.
  - While this was a genetics course, the intervention is easily adaptable to any course in any discipline.
  - This intervention has the possibility of increasing retention in STEM, though longer term research would be required.

Demographics of Assigned Scientists
- Students randomly drew the name of a scientist from a pre-determined pool of 30.
- Due to lab sizes all 30 scientists were not in a single section, but all were represented when sections were combined.
- 10% of scientists were LGBTQ

Student Survey Results
- On last day of class students took an online survey rating the effectiveness of this intervention.
- Rate the helpfulness of the Gene News Now assignment in increasing your understanding of research performed in the field of genetics.

Student reported scientists shifted dramatically from 5% female and 0% Under Represented Minorities (URM) to 15% female and 18% URM.
- Half of the groups categorized scientists based upon their research only (62%).
- Some groups based upon non-research categories such as demographics and geographical information.

Table of Contents Categorization
- Student reported scientists shifted dramatically from 5% female and 0% Under Represented Minorities (URM) to 15% female and 18% URM.
- Half of the groups categorized scientists based upon their research only (62%).
- Some groups based upon non-research categories such as demographics and geographical information.

Pre-Test vs Post-Test Gender

<table>
<thead>
<tr>
<th></th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>61.5</td>
<td>50.8</td>
</tr>
<tr>
<td>Female</td>
<td>38.5</td>
<td>49.2</td>
</tr>
</tbody>
</table>

Pre-Test vs Post-Test Ethnicity

<table>
<thead>
<tr>
<th></th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>51.4</td>
<td>46.3</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>13.5</td>
<td>17.2</td>
</tr>
<tr>
<td>Black/African American</td>
<td>19.9</td>
<td>23.9</td>
</tr>
<tr>
<td>Other</td>
<td>15.2</td>
<td>12.6</td>
</tr>
</tbody>
</table>

Classroom Demographics
- K23 Genetics Laboratory
- Composed of sophomore to seniors, 158 total students
- 6 sections and 1 honors section during Fall 2017 utilized in study
- Each section was instructed by a TA
- Self-reported demographics of all sections

Rate your awareness of the diversity of scientists and their backgrounds in the field of genetics before and after the Gene News Now assignment.
- 1 Manchester University Department of Biology
- 2IUPUI Department of Biology, 3IUPUI Center for Teaching and Learning

Student survey results: I was not partial to it.