!
!
!

"#$%&'()*!+,,-..!/&!01234!

56788-)*-.!7)9!5&##(/#-)/.!

!

!

!

!

!

: -$&%/!&)!7!5&);-%-),-!!

&%*7)(<-9!7)9!6&./-9!=>!

!

16-!?)('-%.(/>!&;!5&8&%79&!@&A89-%!

!

7)9!

!

16-!B6(/-!C&A.-!!

D;;(,-!&;!0,(-),-!7)9!1-,6)&8&*>!E&8(,>!

!

!

6-89!0-$/-#=-%!FF6!FHIJ!

?)('-%.(/>!5&8&%79&!

@&A89-%6!5&8&%79&

!

!

K7)(-88-!57%)('78!B6(/-!C&A.-!D;;(,-!&;!0,(-),-!7)9!1-,6)&8&*>!E&8(,>!

!

L&76!M()N-8./-()G!?)('-%.(/>!&;!5&8&%79&G!@&A89-%!

!

O7/6>!E-%N().G!?)('-%.(/>!&;!5&8&%79&G!@&A89-%!

!

K7)(-8!:-()6&8<G!?)('-%.(/>!&;!5&8&%79&G!@&A89-%

!

B(88(7#!17%7)/()&G!?)('-%.(/>!&;!5&8&%79&G!@&A89-%!

!

5&);-%-),-!0,6-9A8-!

!

\4HH7#4!

"#$%&'()*!+,,-..!/&!01234!

N->)&/-!799%-..!7)9!$8-)7%>!/78N.G!7)9!SJT!,&##A)(/>!(9-)/(;(-9!,678 8-)*-.!7)9!
&$$&%/A)(/(-.!;7,-9!()!#--/()*!().//A/(&)78!,&##(/#-)/.V!16-!%-$&%/!,8&.-.!U(/6!7!
.A**-./(&)!;&%!)-Q/!./-$.!7)9!7!8(./!&;!%-;-%-),-.!(9-)/(;(-9!=>!$7%/(,($7)/.V! !!

/6-!A.-!&;!-'(9-),-

/&!.A$$&%/()*!9(..-#()7/(&)!&;!./%7/-*(-.!9-'-8&$()*!#-/%(,.!;&%!/6-(%!A.-!(.!7!./%7/-*(,!
;&,A.!&;!/6-!++?i.!0123!29A,7/(&)!")(/(7/('-!7)9!/6-!+++0i.!#-7.A%-.!&;!/-7,6()*!
$%7,/(,-.!
! E7%/(,($7)/.!()!/6-!.-..(&)!9(.,A..-9!/U&!,7.-!./A9(-.!&;!/%7).;&%#7/(&).!7/!5?!
@&A8 9-%4!5&),-$/!+..-..#-)/.!()!=(&8&*>!7)9!()/%&9A,/&%>!,&A%.-!%-;&%#!()!$6>.(,.!
5&),-$/!+..-..#-)/.!7%-!#A8/($8-Y,6&(,-!aA-./(&).!()!=(&8&*>!/67/!7%-!A.-9!/&!9(7*)&.-!
,&),-$/A78!9(;;(,A8/(-.!/67/!./A9-)/.!67'-!16->!7%-!)&/!A.-9!;&%!/6-!$A%$&.-!&;!*%79()*!=A/!
A)9-%./7)9()*!6&U!U-8!./A9-)/.!7%-!#--/()*!./7/-9!8-7%)()*!*&78.!16-!7..-..#-)/.!67/0.2(7)-0.9(7

J𝕍 +)!&)*&()*!/-).(&)!-Q(./.!=-/U--)!,67)*()*!/6-!.>./-#!'.𝕍!
,67)*()*!/6-!./A9-)/𝕍!1&!%-788>!.A$$&%/!./A9-)/.!#-7)()*;A88>𝔾!.>./-#(,!,67)*-.!7%-!
%-aA(%-9𝕍!!
^𝕍 +,/('-!8-7%)()*!(.!,%(/(,78!/&!.A$$&%/!./A9-)/.𝔾!
7)9!8-,/A%-𝕐=7.-9!#-/6&9.!#&./!)-*7/('-8>!(#$7,/!A)9-%%-$%-.-)/-9!./A9-)/.𝕍!1&!
.A$$&%/!,67)*-𝔾!;7,A8/>!)--9!%-.&A%,-.!7)9!.A$$&%/𝕍!
`𝕍 0/A9-)/.!)--9!#&)-/7%>!
.A$$&%/𝕍!+=&A/!`Hg!&;!+;%(,7)!+#-%(,7)!./A9-)/.!U&%N!FH!6&A%.!$-%!U--N𝔾!U6(,6!(.!
/&&!#A,6!;&%!7!;A88!/(#-!0123!#7e&%𝕍!D)-!.&8A/(&)!(.!/&!78(*)!U&%N!;&%!#&)->!U(/6!
U&%N!/67/!/%7().!7)9!%-();&%,-.!0123!(9-)/(/>𝕍!!
!
! 27,6!&;!/6-.-!.(Q!(..A-.!,7)!=-!,&))-,/-9!/&!-aA(/>!=%&798>!&%!0123!.$-,(;(,788>𝕍!!
!
!
!
! E-%.(./-),-𝔾!7!,&%-!,&#$&)-)/!&;!%-/-)/(&)𝔾!,7)!=-!.--)!7.!7!.&,(78𝕐$.>,6&8&*(,78!
#7)(;-./7/(&)!&;!#&/('7/(&)𝕍!@>!,%-7/()*!7$$%&$%(7/-!().(/A/(&)78!./%A,/A%-.𝔾!/6-!A)('-%.(/>!
,7)!6-8$!./A9-)/.!=-,&#-!#-#=-%.!&;!/6-!.,(-)/(;(,!,&##A)(/>!=>!()/-%)78(<()*!)&%#.!7)9!
$%7,/(,-.𝕍!16-%-!7%-!/6%--!%-87/-9!,&#$&)-)/.!&;!$-%.(./-),-4!.-8;𝕐-;;(,7,>𝔾!,&##A)(/>𝔾!7)9!
(9-)/(/>𝕍!!
! bE-%,-('-9!.-8;𝕐-;;(,7,>!%-;-%.!/&!&)-i.!=-8(-;.!()!&)-i.!,7$7=(8(/(-.!/&!&%*7)(<-!7)9!
-Q-,A/-!/6-!,&A%.-.!&;!7,/(&).!%-aA(%-9!/&!$%&9A,-!*('-)!7//7()#-)/.c!S@7)9A%7𝔾!I\\jd!$*𝕍!
]T𝕍!B6-)!(/!,&#-.!/&!.-8;𝕐-;;(,7,>𝔾!$-%,-$/(&)!(.!#A,6!#&%-!(#$&%/7)/!/67)!7,/A78!,7$7,(/>d!
.(#$8>!6&89()*!/6-!=-8(-;!/67/!&)-!(.!,7$7=8-!&;!9&()*!.&#-/6()*!(#$%&'-.!$-%;&%#7),-𝕍!
0-8;𝕐

! 16-!B6(/-!C&A.-!*&7!(.!/&!%-9A,-!&..!;%&#!`Hg!/&!^Hg!U6(,6!

!

!

!
! : -=-,,7!@87)N!S567),-88&%!?)('-%.(/>!&;!B(.,&).()Y379(.&)T!7)9!K7)!E&%/-%;(-89!
SE%-.(9-)/G!M%7)N8()!Z!37%.6788!5&88-*-T!%-.$&)9-9!/&!/6-!N->)&/-!799%-..G!6(*68(*6/()*!/6-!
,6788-)*-.!()!7,6(-'()*!/6-!E5+01!*&78.!7)9!78.&!=>!$%&'(9()*!-Q7#$8-.!&;!.A,,-..V!16-!
.$-7N-%.!6(*68(*6/

E7%/(,($7)/.!78.&!$&()/-9!&A/!/67/!(..A-.!&;!'(.(&)!7)9!8-79-%.6($!7%-!&;/-)!
-Q7,-%=7/-9!=>!9(.%A$/('-!,67)*-.!()!'(.(&)⩛!B6-)!/6-%-!(.!7!8&/!&;!/A%)&'-%G!(/!=-,&#-.!
9(;;(,A8/!/&!7,6(-'-!7!,&6-%-)/!,&A%.-!&;!7,/(&)⩛!E7%/(,($7)/.!U&)9-%-9!U67/!,&A89!=-!9&)-!
/&!6-8$!.#&&/6!/%7).(/(&).G!%-,&*)(<()*!/67/!#7)>!$7%/(,($7)/.!U-%-!;7,()*!.A,6!9(.%A$/('-!
,67)*-.⩛!!

!

!

! 5&).(9-%7=8- support is required to enact 7,/('-!8-7%)()*!()!/6-!,87..%&&#⩛!C&U-'-%G!
$7%/(,($7)/!$-%.$-,/('-!.A**-./-9!/67/!/6-%-!(.!8(//8-!(),-)/('-!&%!.A$$&%/!;&%!;7,A8/>!/&!
$A%.A-!/%7).;&%#7/('-!/-7,6()*!$%7,/(,-.⩛!1-7,6()*!7=(8(/>!(.!)&/!-#$67.(<-9!()!6(%()*!
$%&,-9A%-.!&%!()!$%&#&/(&)!7)9!/-)A%-!9-,(.(&).!()!7!#-7)()*;A8!U7>⩛!+.!7!%-.A8/G!-'-)!
;7,A8/>!U6&!U(.6!/&!;&,A.!&)!/-7,6()*!7%-!9(.,&A%7*-9!7)9!$%&'(9-9!)-*7/('-!().,-)/('-.!;&%!
-)*7*()*!()!.A,6!$A%.A(/.⩛!!
! +99(/(&)78>G!;7,A8/>!#-#=-%.!7%-!&;/-)!;&%,-9!/&!/-7,6!87%*-!8-,/A%-!,&A%.-.!()!
,87..%&&#.!/67/!7,/!7.!=7%%(-%.!/&!./A9-)/Y

! E7%/(,($7)/.!6(*68(*6/-9!7!)A#=-%!&;!-7%8>!()/-%'-)/(&)!$%&*%7#.!S-V*V!=%(9*-!;%&#!
OIF!;%-.6#7)!%-.-7%,6!()(/(7/('-.!,&6&%/!#&9-8.T!U6(,6!.6&U!7!8&/!&;!$%&#(.-!;&%!
(#$%&'()*!./A9-)/!%-/-)/(&)V!16-.-!-Q$-%(-),-.!78.&!$%&'(9-!7!=7.(.!;&%!=-//-%!()/-*%7/()*!
./A9-)/!8-7%)()*!/6%&A*6!/6-!$%&*%7#!(;!/6->!,7)!=-!=A(8/!&)!7$$%&$%(7/-8>V!16-%-!(.!'78A-!
;&%!=-//-%!9&,A#-)/()*!U67/!$%&*%7#.!-Q(./!6&U!/6->!U&%N!7)9!6&U!/&!.,78-!/6-#!A$V!!
! 16-!;()78!(..A-!%7(.-9!=>!$7%/(,($7)/.!U7.!&;!7,79-#(,!;%--9&#!7)9!%-.$&).(=(8(/>V!
+/!$%-.-)/!;!7,A8/>!7%-!87%*-8>!,&).(9-%-9!/&!=-!()9-$-)9-)/8>!%-.$&).(=8-!;&%!U67/!*&-.!&)!
()!/6-(%!,87..%&&#.V!+.!/6->!N->)&/-!6(*68(*6/-9!/6-!*&78!(.!)&/!/&!$%-.,%(=-!7!.-/!&;!
#-/6&9.!;&%!;7,A8/>!=A/!*('-)!U67/!(.!N)&U)!7=&A/!6&U!$-&$8-!8-7%)!(/!(.!(#$&%/7)/!/67/!
;7,A8/>!79&$/!7/!8-7./!.&#-!/6-.-!$%7,/(,-.!N)&U)!/&!=-!#&%-!-;;-,/('-V!")!/6(.!.-).-!;7,A8/>!
67'-!7)!&=8(*7/(&)!/&!9&!U67/!(.!N)&U)!/&!=-!=-./!U(/6!/6-(%!./A9-)/.V!16A.!-Q(./.!/6-!
/-).(&)!=-/U--)!;%--9&#!7)9!%-.$&).(=(8(/>V!+.!/6-!)--9!;&%!,67)*-!(.!.>./-#!(/!(.!
(#$&%/7)/!/67/!/6-!#7e&%(/>!&;!;7,A8/>!79&$/!.A,6!$%7,/(,-.!/&!$%&'(9-!7!,&6-%-)/!8-7%)()*!
-Q$-%(-),-!;&%!./A9-)/.V!!
!

!

!
! 16-!,&./!&;!6(*6-%!-9A,7/(&)!(.!&)!/6-!%(.!)!9!/6(.!,7)!=-!7!#7e&%!=7%%(-%!-.$-,(788>!
;&%!./A9-)/.!;%&#!A)9-%%-$%-.-)/-9!*%&A$.V!16(.!6(*68(*6/.!/6-!)--9!;&%!7!.A./7()7=8-!
;A)9()*!#&9-8!/67/!U&%N.!;&%!788!./A9-)/..0003Tc507,08.%!%'4(.40.10.1(2495.840.4(.)0(6)0.e(A)-1())-1

!

@7)9A%7G!+V!SI\\jTV!?%+@5%@@-*$*3:&78%&%)%/*-.%&(@&*(''/(+V!L-U!k&%N4!M%--#7)V!
@&%%-*&G!3VG!Z!C-)9-%.&)G!5V!

E%-.(9-)/i.!5&A),(8!&;!+9'(.&%.!&)!0,(-),-!7)9!1-,6)&8&*>\!SFHIFT\!2)*7*-!/&!2Q,-84!

Conference attendees were asked to share “key resources, articles, books, organizations, and programs” with their fellow participants. Here are their responses.

Academy of Inquiry Based Learning, http://www.inquirybasedlearning.org/

Ambrose, S., Bridges, M., DiPietro, M., Lovett,M., Norman, M., & Mayer, R. (2010). *How Learning Works:!?even Research-Based Principles for Smart Teaching*. Jossey-Bass.

American Society of Engineering Education – Publications, https://www.asee.org/papers-and-publications

BayView Alliance, http://bayviewalliance.org/

Bean, J. C. (2011). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. John Wiley & Sons.

Fairweather, J. (2008). Linking evidence and promising practices in science, technology, engineering, and mathematics (STEM) undergraduate education.

National Research Council. (2013). *Adapting to a Changing World--Challenges and Opportunities in Undergraduate Physics Education*. Washington, D.C.: National Academy of Science.

NSF I-CORP program, http://www.nsf.gov/news/special_reports/i-corps/

Partnership for Undergraduate Life Science Education (PULSE), http://www.pulsecommunity.org/

Physport (formerly, PER User's Guide), https://www.physport.org

President's Council of Advisors on Science and Technology. (2012). Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics. Report to the President. *Executive Office of the President.*

POSSE Program (UW Madison), http://posseprogram.wisc.edu/index.html

Project Kaleidoscope's Summer Leadership Institute, http://www.aacu.org/pkal/stemleadership/index.cfm

Pre-College Enrichment Opportunity Program for Learning Excellence (PEOPLE), http://www.peopleprogram.wisc.edu/index.html

Redish, E. F. (2003). *Teaching physics: with the physics suite*. Hoboken, NJ: John Wiley & Sons.

Singer, S. R., Nielsen, N. R., & Schweingruber, H. A. (Eds.). (2012). *Discipline-based education research: Understanding and improving learning in undergraduate science and engineering*. National Academies Press.

Simbio Virtual Biology Labs, http://simbio.com/

Sousa, D. A. (2011). *How the brain learns*. Corwin Press.

Steele, C. (2010). Whistling Vivaldi: How stereotypes affect us and what we can do. New York, NY: W. W. Norton and Company, Inc.

University of Colorado and University of British Columbia Science Education Initiative, http://www.colorado.edu/sei/, and http://www.cwsei.ubc.ca/

Vision and Change in Undergraduate Biology, http://visionandchange.org/finalreport/

Women in Engineering Programs and Advocates Network (WEPAN), http://www.wepan.org/

Xu, J., Coats, L.T., & Davidson, M. L. (2012). Promoting students interest in science: The perspective of exemplary African American teachers. American Education Research Journal 49(1), 124-154.