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Track 2 GK-12: Sensors!

John F. Vetelino
Principal Investigator; University of Maine, Orono, john.vetelino@maine.edu

Stephen Godsoe
Co-Principal Investigator; University of Maine, Orono

Constance Holden
Co-Principal Investigator; University of Maine, Orono

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Final Report for Period: 02/2011 - 01/2012
Submitted on: 01/31/2012
Principal Investigator: Vetelino, John F.
Award ID: 0538457
Organization: University of Maine
Submitted By:
Vetelino, John - Principal Investigator
Title:
Track 2 GK-12: Sensors!

Project Participants

Senior Personnel

Name: Vetelino, John
Worked for more than 160 Hours: Yes
Contribution to Project:
Please refer to attached files.

Name: Godsoe, Stephen
Worked for more than 160 Hours: Yes
Contribution to Project:
Please refer to attached files.

Name: Holden, Constance
Worked for more than 160 Hours: Yes
Contribution to Project:
Please refer to attached files.

Name: Doore, Brian
Worked for more than 160 Hours: Yes
Contribution to Project:
Please refer to attached files.

Name: Arsenault, Joseph
Worked for more than 160 Hours: Yes
Contribution to Project:
Please refer to attached files.

Post-doc

Graduate Student

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Pls Refer to Appended Document for Data

Other Collaborators or Contacts

Please see Table 5 in attached pdf.

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)
Please see attached program report pdf.

Findings: (See PDF version submitted by PI at the end of the report)
Please see attached program report pdf.

Training and Development:
Please see attached program report pdf.

Outreach Activities:
Please see attached program report pdf.

Journal Publications

None given, "Safe Beneath the Waves", UMaine Engineering, p. 12, vol. Winter, (2007). Published,

None given, "Safe Beneath the Waves", UMaine Today, p. x, vol. Nov., (2006). Published,

Arsenault, J., "Sensors! Alert", Sensors! Alert, p. 1, vol. 2, (2006). Published,

None given, "Grad students inspiring kids to pursue science", Maine Alumni Magazine, p. 5, vol. Spring, (2006). Published,

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Collection: Frontiers in Education Conference, Milwaukee, WI, Oct. 10-13, 2007
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Bibliography: Arsenault, J., C. Holden, S. Godsoe, and J. Vetelino. "Introduction of Sensors to Middle School Classrooms," in Proceedings of 2006 Frontiers in Education Conference (in press)

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Brian E. Doore, Joseph Arsenault, Constance Holden, Stephen Godsoe, John Vetelino, "Work in Progress - Evaluation of the University of Maine GK-12 Sensors! Program", (2008). Book, Accepted
Editor(s): n/a
Collection: Proceedings of the 37th ASEE/IEEE Frontiers in Education Conference
Bibliography: Doore, Brian E, Joseph Arsenault, Constance Holden, Stephen Godsoe, John Vetelino. "Work in Progress - Evaluation of the University of Maine GK-12 Sensors! Program," Proceedings of

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Collection: Bangor Daily News
Bibliography: Haskell, Meg. "Forgotten Bangor cemetery focus of researchers," Bangor Daily News, November 26, 2007: A1, A3.

Web/Internet Site

URL(s):

http://www.eece.maine.edu/research/gk12/

Description:

This site contains information on current activities, fellows and modules.

Other Specific Products

Product Type:

Web site

Product Description:

A catalogue of current portable modules can be found at the following address:

http://www.eece.maine.edu/research/gk12/portablemodule.htm

Sharing Information:

This product will be shared over the internet. GK-12 Sensors is also collaborating with Dr. Gary Ybarra and Dr. Paul Klenk of Duke University to incorporate the GK-12 module library into their online resource TeachEngineering.com.

Contributions

Contributions within Discipline:

JOURNAL PUBLICATIONS

Co-authored with GK-12 fellows Chris York and Lester French: 'A Lateral Field Excited Acoustic Wave Biosensor,' Chemical Sensors Vol. 20, SupB, pp. 212-213, 2004. (Co-authored with C. York, L. French, Y. Hu and P. Millard.)

Co-authored with GK-12 fellows Wade Pinkham and Lester French: 'Pesticide Detection Using A Lateral Bulk Excited Acoustic Wave Sensor,' Chemical Sensors Vol. 20, SupB, pp. 262-263, 2004 (Co-authored with W. Pinkham, L. French, Y. Hu and D. Frankel.)

Co-authored with GK-12 fellow Lester French: 'A Lateral Field Excited Liquid Acoustic Wave Sensor,' IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, Vol. 51, No. 11, pp. 1373-1380, 2004. (Co-authored with Y. Hu, L.A. French, K. Radecsky, M.P.

daCunha, and P. Millard.)

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Co-authored with GK-12 fellows Don McCann, Jason McGann and Jesse Parks: 'Lateral Field Excited LiTa03 High Frequency Bulk Acoustic Wave Sensor,' IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, Vol. 56, No. 4, pp. 779-787, 2009. (Co-authored with D. F. McCann, J.M. McGann, J.M. Parks, D.J. Frankel and M.P. daCunha.)

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Co-authored with GK-12 fellow Lester French: 'A Lateral Field Excited Liquid Acoustic Wave Sensor,' 2003 International Ultrasonics Symposium Proceedings, Honolulu, Hawaii, pp 46-51, Oct. 2003. (Co-authored with Y. Hu, K. Radecsky, L. French, P. Millard and M. DaCunha.)

Co-authored with GK-12 fellow Lester French: 'Electrode Optimization from Lateral Field Excited Acoustic Wave Sensors,' 2004 IEEE Ultrasonics, Ferroelectrics and Frequency Control Symposium, Montreal, Canada, pp. 314-318, Aug. 23-27, 2004. (Co-authored with L. French, C. York, M. Meissner, G. Bernhardt and M. DaCunha.)

Co-authored with GK-12 participating teacher Tracy Vassiliev: 'Heavy Metal Concentrations in Lobster (Homarus Americanus),' National Shellfisheries Association Program and Abstracts of the 97th Annual Meeting, p. 54, April 2005. (Co-authored with T. Vassiliev, R. Bayer, W. Congelton and R. Bushway.)

Co-authored with GK-12 fellows Chris York and Lester French: 'A Lateral Field Excited Acoustic Wave Biosensor,' 2005 IEEE International Ultrasonics Symposium, Rotterdam, The Netherlands, pp. 44-49, Sept. 19-21, 2005 (Co-authored with C. York, P. Millard and L. French).

Co-authored with GK-12 fellows Wade Pinkham and Lester French: 'A Lateral Field Excited Acoustic Wave Pesticide Sensor,' 2005 IEEE International Ultrasonics Symposium, Rotterdam, The Netherlands, pp. 2279-2283, Sept. 19-21, 2005 (Co-authored with W. Pinkham, L. French, M. Wark, S. Winters and D. Frankel.)

Co-authored with GK-12 fellows Jesse Parks and Don McCann: 'Crystal Orientation for Lateral Field Excited Sensor Applications,' 11th International Meeting on Chemical Sensors (IMCS), Brescia, Italy, July 16-19, 2006. (Co-authored with Jesse Parks and Don McCann.)

Co-authored with GK-12 fellow Don McCann: 'A Novel Monolithic Spiral Coil Acoustic Transduction Sensor,' 11th International Meeting on Chemical Sensors (IMCS), Brescia, Italy, July 16-19, 2006. (Co-authored with D. McCann, G. Flewelling, and G. Bernhardt.)

Co-authored with GK-12 fellows Wade Pinkham and Mitchell Wark: 'Detection of Phosmet in Apples Using a Lateral Field Excited Acoustic Wave Sensor,' 11th International Meeting on Chemical Sensors (IMCS), Brescia, Italy, July 16-19, 2006. (Co-authored with W. Pinkham, M. Wark and D. Frankel.)

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Co-authored with GK-12 fellow Don McCann: 'A Monolithic Spiral Coil Acoustic Transduction Sensor,' 2006 IEEE Ultrasonics Symposium, Vancouver, B.C., pp. 890-893, Oct. 3-6, 2006. (Co-authored with D. McCann, G. Flewelling and G. Bernhardt.)

Co-authored with GK-12 fellows Lester French, Don McCann, Mitchell Wark and Shane Winters: 'A Lateral Field Excited Acoustic Wave Sensor,' Transducers and Eurosensors XXI 2007, Lyon, France, June 10-14, 2007, pp. 1287-1290. (Co-authored with L. French, D. McCann,

M. Wark and S. Winters.)

Co-authored with GK-12 fellow Don McCann: 'Compact RF Impedance-Spectrum-Analyzer for Lateral Field Excited Liquid Acoustic Wave Sensor,' Proc. of IEEE Sensors 2007 Conference, pp. 280-283. (Co-authored with T. Schneider, U. Hempel, S. Doerner, D. McCann and P. Hauptmann.)

Co-authored with GK-12 fellows Don McCann, Jesse Parks and Jason McGann: 'Lateral Field Excited High Frequency Bulk Acoustic Wave Sensor,' Proc. of 2007 IEEE Ultrasonics Symposium, New York, NY, Oct. 28-31, 2007, pp. 264-267. (Co-authored with D. McCann, J. Parks, J. McGann and M. daCunha.)

Co-authored with GK-12 fellow Mitchell Wark: 'A Lateral Field Excited Acoustic Wave Sensor for the Detection of Saxitoxin in Water,' 2007 IEEE Ultrasonics Symposium, New York, NY, Oct. 28-31, 2007, pp. 1217-1220. (Co-authored with M. Wark, B. Kalanyan, L. Ellis, J. Fick, D. Neivandt and L. Connell.)

Co-authored with GK-12 fellows Don McCann, Mitchell Wark and Lester French: 'Novel Transducer Configurations for Bulk Acoustic Wave Sensors,' 2008 IEEE Conference, Lecce, Italy, Oct. 26-29, 2008, pp 1448-1451. (Co-authored with D.F. McCann, M.S. Wark, and L.A. French.

Co-authored with GK-12 fellows Don McCann and Mitchell Wark: 'The Detection of Chemical and Biological Analytes Using a Monolithic Spiral Coil Acoustic Transduction Sensor,' 2008 IEEE Ultrasonics Symposium, Beijing, China, Nov. 2-5, 2008, pp. 1187-1190. (Co-authored with D. McCann, M. Wark, P. Millard and D. Neivandt.)

Co-authored with GK-12 fellow Shane Winters: 'Monolithic Lateral Field Excited Well Structures in Quartz,' 2008 IEEE Ultrasonics Symposium, Beijing, China, Nov. 2-5, 2008, pp. 272-275. (Co-authored with S. Winters, G. Bernhardt and D. Frankel.)

Co-authored with GK-12 fellows Don McCann and Mitchell Wark: 'A Monolithic Spiral Coil Acoustic Transduction E. coli Sensor,' The 12th International Meeting on Chemical Sensors, Columbus, Ohio, July 13-16, 2008, p. 21. (Co-authored with D.F. McCann, M. Wark, J. Evans and P. Millard.)

Co-authored with GK-12 fellow William Spratt: 'Torsional Wave Sensing of Temperature and Liquid Level,' 2009 IEEE Frequency Control Symposium, Besancon, France, Apr. 20-24, 2009, pp. 850-854. (Co-authored with W. Spratt.)

Co-authored with GK-12 fellows Jason McGann, Kristopher Sgambato and Don McCann: 'Acoustic Mode Behavior in Lateral Field Excited Sensors,' 2009 IEEE Ultrasonics Symposium, Rome, Italy, Sept. 20-23, 2009, pp. 645-648. (Co-authored with J. McGann, K. Sgambato, D. McCann and C. Peters.)

Co-authored with GK-12 fellow Don McCann: 'The Electromagnetic Fields Radiated From a Monolithic Spiral Coil Acoustic Transduction Sensors,' 2009 IEEE Ultrasonics Symposium, Rome, Italy, Sept. 20-23, 2009, pp. 721-724. (Co-authored with D. McCann.)

Co-authored with GK-12 fellow William Spratt: 'Liquid Level Torsional Acoustic Waveguide Sensor,' 2009 IEEE Ultrasonics Symposium, Rome, Italy, Sept. 20-23, 2009, pp. 663-668. (Co-authored with W. Spratt and L. Lynnworth.)

Co-authored with GK-12 fellow William Spratt: 'Liquid Level Torsional Waveguide Sensor,' 2010 IEEE Ultrasonics Symposium, San Diego, CA, Oct. 11-14, 2010, pp. 702-706. (Co-authored with W. Spratt and L. Lynnworth)

Co-authored with GK-12 fellows Don McCann and Jason McGann: 'Lateral Field Excited LiTaO3 Acoustic Wave Sensing Platform,' 2010 IEEE Ultrasonics Symposium, San Diego, CA, Oct. 11-14, 2010, pp. 938-941. (Co-authored with D. McCann and J. McGann)

Co-authored with GK-12 Shane Winters: 'A Lateral Field Excited Acoustic Sensor Array,' 2010 IEEE Ultrasonics Symposium, San Diego, CA, Oct. 11-14, 2010, pp. 942-945. (Co-authored with S. Winters and G. Bernhardt.)

Co-authored with GK-12 fellow Don McCann: 'Optimization of the Lateral Field Excited Platform for Liquid Sensing Applications,' Proceedings Eurosensors XXIV, Linz, Austria, Sep. 5-8, 2010, pp. 1224-1227. (Co-authored with C. Peters, R. Fernandez, R. Lucklum, J. Fochtmann, D. McCann, and A. Arnau)

Contributions to Other Disciplines:

Please see attached program report pdf.

Contributions to Human Resource Development:
Please see attached program report pdf.

Contributions to Resources for Research and Education:
Please see attached program report pdf.

Contributions Beyond Science and Engineering:
Please see attached program report pdf.

Conference Proceedings

Categories for which nothing is reported:

Any Conference

National Science Foundation▪University of Maine GK-12 Sensors! ▪Final Report

John F. Vetelino, Principal Investigator

Table 1. Senior Personnel 2010-2011 (Page 1 of 1)

Name	Position	Description of position	Length of time worked on project	Institutional affiliation & position	Contribution statement
John Vetelino	Principal Investigator	Makes final decisions on fellow selection, directs fellow activities, sets guidelines for module development, facilitates communication between GK-12 Sensors! schools, fellows and UM faculty, attends GK-12-related conferences.	9.5 yrs	University of Maine Department of Electrical & Computer Engineering, Professor	Has worked for at least 160 hours in the past reporting year of the project
Constance Holden	Co-Principal Investigator	Brings K-12 teaching experience to the task of supporting and training GK-12 fellows, interacting with civic leaders, helping administer the program.	9.5 yrs	University of Maine Department of Spatial Information Science & Engineering, Instructor	Has worked for less than 160 hours in the past reporting year of the project
Brian Doore	Program Evaluator	Responsible for all aspects of program evaluation: Administers surveys, focus groups, interviews and classroom observations; analyzes & reports evaluation data to PI and co-PIs.	5 yrs	Center for Research and Evaluation, Research Associate	Has worked for less than 160 hours in the past reporting year of the project
Joe Arsenault	Program Coordinator	Coordinates GK-12 Sensors activities and meetings; acts as liaison between Co-PIs, fellows and teachers; prepares articles, reports and informational presentations; assists fellows in developing modules and conference presentations; advocates for ongoing support; works with fellows to establish auxiliary support for GK-12 related activities.	7.5 years	University of Maine Department of Electrical & Computer Engineering, Staff Technical Writer	Has worked for at least 160 hours in the past reporting year of the project

Table 2. Graduate Students. 2011 (Page 1 of 1)

Name	Year in graduate program	Major	Research topic	Statement of graduate location & nature of graduate work	Ethnicity & Gender
William Spratt	4th year PhD	Mechanical Engineering	Guided-Wave Ultrasonic Sensor for Temperature Measurements	UM Department of Electrical and Computer Engineering, doing research, collecting data	Caucasian, male
Brian Tomassetti	3nr year MS	Electrical Engineering	Analysis of Lobster Hemolymph Using a Spectographic Sensing System	Department of Electrical and Computer Engineering, doing research, collecting data	Caucasian, male
Shane Winters	4th year MS	Electrical Engineering	Multiple-Well Lateral Field Excited Sensor Platforms	UM Department of Electrical and Computer Engineering, doing research, collecting data, writing thesis	Caucasian, male

Table 3. Fellows Tracking 2002-20011 (Page 1 of 2)

Last Name	First Name	Graduation Status	Degree Obtained	Current Position	E-mail	Phone
Berkenpas	Eric	Graduate	MS Electrical Eng.	Electrical Engineer, Remote Imaging Department, National Geographic Society, Washington, D.C.	n/a	800.548.9797
Bolton	Jason	3rd Yr. PhD	MS Food Science & Human Nutrition	UM Graduate Student, Food Science & Human Nutrition, University of Maine Cooperative Extension Assistant Extension Professor for Food Safety	Jason.bolton@maine.edu	207.942.7396
Clark	Aaron	None	BS Mathematics, Chemical Eng.	Mathematics Teacher, Mt. View High School, Thorndike, ME	aclark@msad3.org	207.568.3255
Donovan	Danielle	Graduate	MS Spatial Info Eng.	Science Teacher, Hampden Academy, Hampden, ME	ddonovan@sad22.us	207.862.3791
Doore	Stacy	2nd Yr. Ph.D	MS Spatial Info Eng.	UM Graduate Student, Spatial Info Engineering	stacy.doore@umit.maine.edu	207.581.2188
Duy	Janice	5th Yr Ph.D	BS Electrical Eng.	UM Graduate Student, Biological Engineering	janice.duy@umit.maine.edu	n/a
French	Lester	Graduate	Ph.D Interdisciplinary: Materials Sciences	Adjunct Instructor, School of Science & Humanities, Husson University; Adjunct Instructor, Mathematics, Eastern Maine Community College	frenchl@fc.husson.edu	207-745-1375
Gallimore	Dana	7th Yr. Ph.D	BS Electrical Eng.	UM Graduate Student, Electrical Engineering	dana.gallimore@umit.maine.edu	n/a
Hedefine	Eeva	Graduate	MS Spatial Info Eng.	Staff Engineer, James W. Sewall Co., Old Town, ME	ehedefine@jws.com	207.827.4456
Isenberg	Douglas	None	BS Electrical Eng.	Unknown	n/a	n/a
Kennard	Raymond	8th year PhD	MS Chemical Eng.	UM Graduate Student, Chemical Engineering, Systems Engineer, OSS Inc,Bangor, ME	raymond.kennard@umit.maine.edu	866.269.8007
Kenney	Crystal	Graduate	MS Electrical Eng.	Ph.D Candidate, Nanoelectronics Lab, Stanford University	ckenney@stanford.edu	n/a
Krassikoff	John	Graduate	Ph.D Physics	Raytheon Missile Systems Company, m/s 840/9, Tucson, AZ 85706	John_Krassikoff@raytheon.com	n/a
Lampron	Kenna	None	BS Electrical Eng.	Unknown	n/a	n/a
Lewark	Michael	Graduate	MS Electrical Eng.	Electrical Engineer, 3-C Electric Company, 2 Stone Ledge Drive, Lewiston, ME 02056	n/a	508.881.3911
Mahaffey	Christie	7th Yr. Ph.D	BS Marine Sciences	UM Graduate Student, UM Department of Mechanical Engineering, School of Marine Sciences	christie.mahaffey@umit.maine.edu	207.581.2120

Table 3. Fellows Tracking 2002-2011 (Page 2 of 2)

Last Name	First Name	Graduation Status	Degree Obtained	Current Position	E-mail	Phone
Martin	Andrea	Graduate	Ph.D Chemistry	High School Chemistry Teacher, teaching in Indiana, details unavailable	n/a	n/a
McCann	Donald	Graduate	Ph.D Electrical Eng.	Technical Manager & Senior Engineer, Environetix Technologies, Orono, ME	dmccann@environetix.com	207.866.6551
McCarthy	Erik	Graduate	MS Biological Eng.	Engineer, Environetix Technologies, Orono, ME	emccarthy@environetix.com	207.866.6551
McGann	Jason	Graduate	MS Electrical Eng.	Triquint	jason.mcgann@tqs.com	n/a
Nagy	Edwin	Graduate	Ph.D Civil Eng.	Lecturer, University of Maine Dep't of Civil & Environmental Engineering	edwin.nagy@maine.edu	(207) 581-2164
Neumann	Bradley	Graduate	MS Resource Economics & Policy	Land Policy Educator, MSU Extension--St. Joseph County, 612 E. Main Street, Centreville, MI 49032	neuman36@msu.edu	(p) 269.467.5522 (f) 269.467.5641
Parks	Jesse	None	BS Electrical Eng.	Unknown	n/a	919.360.1721
Pinkham	Wade	Graduate	MS Electrical Eng.	Staff Engineer, Bath Iron Works, Bath, ME	wade.pinkham@umit.maine.edu	207.438.2071
Pitcher	Stephanie	Graduate	MS Electrical Eng.	Defense Control Management Agency, Tewksbury, MA	stephanie.pitcher@dcma.mil	978.858.1802
Puckett	Anthony	Graduate	Ph.D. Mechanical Eng.	Technical Staff Member, ESA-WR, MS-T001, Los Alamos National Laboratory, PO Box 1663, Los Alamos, NM 87545	apuckett@lanl.gov	505.663.5130
Sgambato	Kristopher	Graduate	MS Electrical Eng.	National Security Agency, Washington, DC	kristopher.sgambato@umit.maine.edu	1418 Riverside Ave., Baltimore, Maryland 21230
Shareef	Ali	3rd yr. PhD	MS Electrical Eng.	UM Graduate Student, Electrical Engineering	ali.shareef@umit.maine.edu	n/a
Thiele	Jeremy	Graduate	MS Electrical Eng.	Electrical Engineer, Hascom Air Force Base, Hanscom Field, MA	jeremy.thiele@umit.maine.edu	781.377.3846
Walker	Judith	Graduate	MS Resource Economics & Policy	Economist, URS Corporation, 200 Orchard Ride Driver, Suite 101, Gaithersburg, MD 20878	judith_walker@urscorp.com	(c) 301.542.3124 (o) 301.258.5912
Wark	Mitchell	Graduate	MS Electrical Eng.	Portsmouth Naval Shipyard, Kittery, ME	mitchell.wark@umit.maine.edu	207.438.1000
Woodard	Becky	Graduate	Ph.D Eng. & Marine Science	Research Assistant Professor, Department of Mechancial Engineering, University of Maine	Becky.woodward@maine.edu	(207) 581-2149
York	Chris	Graduate	MS Electrical Eng.	Portsmouth Naval Shipyard, Kittery, ME	n/a	207.438.1000

Table 4A. Organizational Partners for GK-12: Sensors! 2011 (Page 1 of 1)

Name	Type	Characteristics	Description of activities	Number of fellows & Teachers	Subject area & grade level fellow & teacher teams teaching
Brewer High School	Public High School	Type of School: Urban; % of free or reduced price Lunch: 27.74; % minority: 4.13. Academic standing: Does not meet state average in reading; meets state average in mathematics; exceeds state average in science. (For federal standing, see Table 4B.)	Teachers assist fellows build sensors-integrated activities into school's science curriculum	1 Fellow, 1 Teacher	Mathematics (9-11)
Brewer Middle School	Public Middle School	Type of School: Urban % of free or reduced price lunch: 31.8; % minority: 5.96. Academic standing: Exceeds state average in reading; meets state average in mathematics; does not meet state average in science. (For federal standing, see Table 4B.)	Teachers assist fellows build sensors-integrated activities into school's science curriculum	1 Fellow, 1 Teacher	7th-grade science
Caravel Middle School	Public Middle School	Type of School: Rural; % of free or reduced price lunch: 40.09; % minority: 1.77. Academic standing: Does not meet state averages in reading, mathematics or science. (For federal standing, see Table 4B.)	Teachers assist fellows build sensors-integrated activities into school's science curriculum	1 Fellow, 2 Teachers	7th-grade science, 8th-grade science
Hermon High School	Public High School	Type of School: Rural; % of free or reduced price lunch: 24.26; % minority: 5.13. Academic Standing: Does not meet state averages in mathematics, reading or science. (For federal standing, see Table 4B.)	Teachers assist fellows build sensors-integrated activities into school's science curriculum.	1 Fellow, 1 Teacher	Mathematics (9-12)

Table 4B. 2010-11 participating school "No Child Left Behind" standing

Abbreviations:
AYP Adequate Yearly Progress
CIPS1 School did not make AYP in the same subject for two years
CIPS2 School did not make AYP in the same subject for three years
CIPS-R School CIPS status still in review

School District	School Name	Title 1 School	Reading Status & Identification Codes	Math Status & Identification Codes
Brewer School Dept	Brewer High School		CIPS-R	CIPS2
Brewer School Dept	Brewer Middle School		No Data*	No Data*
Hermon School Dept	Hermon High School		CIPS2	CIPS2
S.A.D. 23	Caravel Middle School	yes	Making AYP	Making AYP

*School was closed. The new school, Brewer Community School, is a new configuration with no status, and for which no data are available.

Table 5. Other 2010-11 collaborators with GK-12 Sensors!

Name	Type of Contribution	Statement of Contribution
University of Maine Office of Vice President for Research, Graduate School	Facilities, Financial	Full support of INT 570, "Emerging Science and Technology Integration Into K-12 Classrooms" into UM ongoing graduate curriculum and as a requirement for PhD graduate students in science and engineering.
Laboratory for Surface Science and Technology (LASST), Dr. Robert Lad, Director and Professor of Physics	Facilities	Provides access to facility for middle/high school tours.
Dr. John F. Vetelino, Professor of Electrical Engineering, UM	Fellow support	Serves as advisor to GK-12 fellows Don McCann, Jason McGann, Kyle Spratt, Brian Tomassetti and Shane Winters.
Dr. David Frankel, Senior UM Research Scientist	In-kind	Facilitated tours of various UM laboratories for visiting GK-12 participant high/middle school students.
Dr. George Bernhardt, UM Research Scientist	In-kind	Facilitated tours of various UM laboratories for visiting GK-12 participant high/middle school students.
Michael Call, UM Research Engineer	In-kind	Facilitated tours of various UM laboratories for visiting GK-12 participant high/middle school students.

NATIONAL SCIENCE FOUNDATION
UNIVERSITY OF MAINE NSF GK-12: SENSORS! PROJECT (2002-2011)

FINAL REPORT:
OUTCOMES, BEST PRACTICES, LESSONS LEARNED, SUSTAINABILITY

I. INTRODUCTION:

The primary goal of the GK-12: Sensors! project is to capitalize on University of Maine's (UM's) interdisciplinary, state-of-the-art sensor science and engineering resources to establish strong partnerships with middle and high schools that benefit GK-12 fellows, teachers, middle and high school students, senior personnel, and community and business stakeholders, with a strong emphasis on program sustainability, comprehensive evaluation, and proactive dissemination. Specific goals include

- Encouraging Maine students to attain undergraduate and graduate degrees, especially in STEM fields
- Encouraging Maine students to attend UM or to return to Maine to expand the number of scientists and engineers contributing to the state's economy
- Preparing Maine students for careers utilizing sensors
- Fostering long-term partnerships between the schools, UM and community groups
- Disseminating model curricula so that other research topics (i.e. wireless communications, nanotechnology, genomics etc.) can fuel the development of other innovative curricula in the nation's high schools
- Encouraging interdisciplinary research and teaching related to sensor science and engineering
- Encouraging business innovation in Maine through a more educated workforce and facilitating greater industry involvement in Maine high schools
- Improving the public perception of higher education

II. PROGRAM OUTCOMES:

GK-12 Sensors! Track II Summary Annual Participation Data 2002-2011

Year	Total No. Schools	High	Middle	No. Teachers	No. Students	No. Fellows
2002-03	2	2	0	18	1075	10
2003-04	6	6	0	27	1300	14
2004-05	15	9	6	43	2000	15
2005-06	15	8	7	27	1900	10
2006-07	15	8	7	27	1550	12
2007-08	13	6	7	24	1500	10
2008-09	11	4	7	15	950	8
2009-10	9	4	5	17	700	8
2010-11	4	2	2	5	250	3

Student Evaluation Impact Summary: Program evaluation performed student surveys in Fellows' cooperating classes (grades six to twelve) to determine the impact of the GK-12 program on students' interest in STEM, and future aspirations to study STEM at the college level. Results averaged over years surveyed indicate:

- Most respondents planned to attend college, about a third intending to pursue an advanced degree.
- When asked whether they would like to study STEM in college, about 40% indicated they would, 20% would not, and 40% were not sure.
- Nearly 90% of respondents expected to do *well* or *very well* in the STEM courses they were enrolled in at the time of survey.
- About a third of respondents said STEM courses were their *favorites*, while half said they were *OK, but not my favorites,* the balance expressing a general dislike of STEM courses.
- Students were very positive about the degree of impact the Fellows had on them personally:
    - About three-quarters indicating that they became more confident in their STEM class because of the GK-12 Fellow (1% suggested they were *less* confident)
    - About 60% said they liked the class more because of the GK-12 Fellow (3% said they liked the class *less*.)
    - Respondents generally indicated that GK-12 graduate students had increased their knowledge in their classes, increased their interest in their classes, and made them more likely to study STEM in the future.

Fellows have reported student interest in pursuing STEM education and careers as a result of classroom interactions, hands-on activities and field trips to University of Maine research laboratories. Increased student interest has also been noted in response to Fellow involvement in regional and state STEM conventions showcasing middle-school student inventions and statewide GIS conferences and competitions for high-school students. Several students have pursued STEM studies at UM as a result of both previously mentioned activities along with Fellow-mentored opportunities to perform summer research internships/activities with UM faculty. Fellows, working with lead teachers and program management, have also provided individual tours of UM research facilities and meetings between STEM-engaged students and UM STEM research faculty, as well as with appropriate college Deans or other UM administration.

Modules (See Sustainability)

Curricular Development at K-12 Schools (See Sustainability)

Curricular Development at UM (See Sustainability)

III. BEST PRACTICES:

New Cooperating Teacher Development Through Associated RET Program: Throughout the course of the GK-12 Sensors! project, a UM NSF RET-Sensors! program (Vetelino, PI) has been the primary mechanism for establishing direct contact with schools. Up to ten middle and high school teachers each summer are awarded eight-week fellowships at UM to be involved in cutting-edge research in sensor theory, design, fabrication, testing, and/or applications. Teachers interact daily with faculty, senior researchers, graduate students, GK-12 *Sensors!* fellows, and NSF Research Experience for Undergraduates (REU) students in the UM Laboratory for Surface Science & Technology (LASST). The RETs are involved in research on biosensors, chemical sensors, and fluid-phase sensors, and become familiar with state-of-the-art sensor-related science and technology facilities and neighboring sensor businesses. RETs also enroll in a course entitled *Introduction to Sensors*, which presents the theory and applications of various types of sensors, for which they receive academic and recertification credit. RETs work in concert with GK-12 fellows developing possible modules to be introduced into high and middle school curricula. The summer program concludes with the August Summer Workshop, where RETs share both their summer research experience

in formal presentations and their proposed modules. All RET participants become GK-12 *Sensors!* cooperating teachers, continuing working relationships established during the summer RET program with GK-12 fellows.

Lead Participating Teacher Advisory Board (LPTAB): For each participating school district, a lead teacher was selected. These teachers act as liaisons between their school district and the program, interfacing with school administration and department heads, coaching Fellows (particularly new Fellows) and new teachers. LPTAB members also serve on the selection committee for new Fellows and assist in identifying teachers at lower grade levels to participate. Lead teachers assist in determining merit pay for cooperating teachers, assist program staff in understanding the needs for materials and in the delivery of a summer workshop on how to design and implement effective science instruction, meet periodically with program staff, school guidance counselors and principals to discuss program implementation and attend bi-monthly meetings to discuss issues with other lead teachers and program staff.

Integration of STEM Materials into Community-Based Projects: GK-12 Sensors! Fellows, teachers and students enrolled in GIS in Geography at Bangor High School work with Bangor city government, public safety officials and area organizations to identify local needs where their research skills and geospatial and sensor technology can be applied. The contributions to the local community that have resulted from these collaborations have been recognized by local and national organizations. Highly visible partnerships and resultant products provide sustainable evidence of how GK-12-type programs can benefit local communities by serving as a catalyst for community improvement. The GK-12 Sensors!-BHS collaboration has positively impacted civic agencies and organizations in the City of Bangor, Maine, by generating or modernizing products and services. The success of this community outreach model relies on the following elements:

- GK-12 Fellows work with high-school teachers to build project-based curriculum using an established engineering design process model
- Student project-teams are treated as GIS consulting firms working to provide geographic solutions (maps, research, presentations) to community organizations
- Community agencies are directly involved with students, teachers and Fellows to identify areas of need and available resources, and remain engaged throughout process

By linking learning to public service, student engagement and interest in pursuing STEM-related areas is increased. Students learn in an applied context that fosters both personal and civic responsibility. The GK-12 Fellow serves as an in-class STEM role model and as a project facilitator, assisting both teacher and student. The interaction of municipal personnel with students, teachers and fellows is the constitutive dynamic of the community outreach effort. As communities inherently have interest in and willingness to strengthen its school system, the model described here of generating curricular materials from community needs and producing highly visible, positive impacts on the community is a model that can be adapted to the needs of communities, whether rural, suburban or urban.

IV. LESSONS LEARNED:

The original premise for both Track I and Track II, in line with initial expectations of NSF program managers, was that teachers would welcome the opportunity to rethink their curriculum using enriched content by working with a content expert. While teachers eagerly embraced the concept, implementation proved to require more than interest. The key missing piece of the premise was recognizing that teachers generally feel overstretched trying to accomplish existing curricular goals. “Reform on the fly” working with GK-12 fellows who are not also educators or education experts produces novel challenges to teachers, and the general response is to find “value-added” solutions. The complexity of the task placed on teachers working with and integrating fellows into classrooms was simply not recognized, especially for new teachers and/or new fellows. Thus the expectation for change and rate of implementation was scaled to fit the abilities and availability of participating teachers.

GK-12 Sensors! sought to bring new teachers into the program 'virally', through interactions with cooperating teachers at a school, encouraging initial core of cooperating teachers to 'expand' reach of program and 'share' fellows with other (STEM) teachers. However, without an explicit orientation workshop or program introduction beyond a written welcome and introductory literature, individualized perceptions of the GK-12 Sensors! program and its goals developed, producing confusion about the roles of the fellows and the program. The introduction of Lead Teachers instituted a process of both monitoring teacher interest in the program and a channel for project personnel to quickly make the needed one-on-one contact to ensure that all participants are on the 'same page'.

Another aspect of managing program perception at schools involves clear communication with administrators. Regular contact with principals and superintendents, and at school board meetings with teachers, sharing examples of integration, produces strong, consistent support throughout districts. Maintaining a high profile also offers opportunities to seed concepts of curricular and financial program sustainability to school administrators, community members and parents.

However, despite the demonstrably positive impact of the program on student aspirations and ability, program sustainability in the form of dollars is a hard sell, especially in a poor state whose economic base is primarily very small ('under 15') businesses. The few large potential corporate sponsors/partners have well-established relationships with UM and their monies are prioritized exhaustively through the Office of Development. Efforts to either directly legislate monies or allocate from existing university resources put GK-12 in direct competition with a range of other stakeholders seeking broad-based ongoing funding. At the state level, the question of sustainability was addressed extensively in collaboration with two other GK-12 programs (UM, Brawley, PI; University of Southern Maine, Duboise). A bill was submitted to the legislature to obtain sustained funding. The measure was passed but no funds were allocated. The challenges the project has encountered to the cases made to the State, to the university and to participating GK-12 school departments might be summarized as follows:

- The annual dollars for the fellowship plus the cost of education was perceived to be way out of line with statewide pay-scales for comparable education-related jobs, especially full-time teachers
- Directing 'financing' grad students fellowships appeared risky for several reasons: 1. There was no indisputable 'hard evidence' that these graduate fellows are improving school and student performance; 2. Even supposing the existence of indisputable hard evidence, the real return to tax payers for the dollars invested in these fellows was unclear
- While certainly a knowledge-based, high-tech trained entrepreneurial graduate workforce is recognized by numerous state- and/or privately funded state studies as critical to building Maine's economic future, the state has an urgent responsibility to focus investment on strengthening the STEM learning of the K-12 learners, rather than for fellowships to already highly STEM-trained workforce-ready post-12 students

How any GK-12-type program could be scaled statewide and remain effective remains an unanswered question. However, from these repeated conversations and efforts to secure a long-term footprint for the GK-12 Sensors! program in currently participating schools and possibly beyond an alternative has been articulated, one that does not focus directly on the advantages of and support for placing graduate fellows in K-12 schools. Instead, *the focus is on building the infrastructure within UM needed to coordinate UM STEM research units and outreach to K-12 schools, with graduate students as the primary intermediaries*. In this model, the university would serve as a hub, providing collaborating schools with resource and knowledge sharing. UM STEM coordinators and K-12 teachers.

V. SUSTAINABILITY:

Fellows' Experience: Evaluation reports consistently indicate that Fellows credit their GK-12 experience with providing better communications skills and confidence in public speaking in a variety of professional settings.

K-12 Student Experience: See OUTCOMES.

K-12 Teachers' Experience: Over the lifetime of the project, more than 30 GK-12 participating teachers have either participated in research experiences at UM or elsewhere during or preparatory to their participation in the project, strengthening the STEM research experience basis of area science teachers, using sensors-integrated curricula developed with GK-12 fellows.

K-12 Schools Curricular Impact: First in the nation course integrating GIS and geography using an engineering design process model at Bangor High School; Development of engineering design module with sensors component in 6th and 8th grade Reeds-Brook Middle School science curriculum (Hampden), Development of Food Science & Invention design and development module with sensors component in 7th and 8th grade Bangor middle school science curricula, development of sensors-based modules integrated with Maine Laptop Initiative for Brewer middle school science curricula; implementation of sensors science and engineering modules into biology, chemistry and physics curricula (Bucksport, Hermon); integration of sensors-based activities and awareness models throughout middle school science curricula (Caravel, Indian Island).

Modules: A collection of more than 75 sensors-implemented active learning modules has been developed over the course of the project. The program is in discussion with the Maine Mathematics and Science Alliance (http://www.mmsa.org/) to provide it with the learning modules library, for easy and centralized online access to all Maine (and New England) STEM educators.

UM Curricular Impact: The following courses have been introduced as a result of GK-12 activities: INT 465, Introduction to Sensors (undergraduate/graduate); INT 570, Emerging Science and Technology Integration Into K-12 Classrooms (graduate) (this course, the development of the curriculum modules, and commitments in the high schools help fellows hone time management, teamwork and communication skills and is still under consideration as a core requirement for all STEM graduate programs at UM); EDT 598 Geographical Information Systems for Education (graduate).

Sustainability Financing Efforts: Despite repeated efforts each year of the phase two project to identify long-term funding sources to sustain GK-12 type efforts in participating schools and throughout the state at university, school-district, community, regional and state levels, especially focused on efforts to build university-K-12 school-community-industry partnerships, it seems larger economic factors conspired to make ordinary educational, community and business resources too scarce for such "luxuries" as GK-12 -type activities. (Cf. Lessons Learned.)

However, on the basis of the positive experience students, teachers and school administrations had with the GK-12: Sensors! Program, the GK-12 Sensors! PI has worked with teachers and administrators in GK-12 participating school districts to develop a NSF Discovery Research K-12 proposal for January 2012 submission. The proposal leverages existing linkages and relationships fostered throughout the tenure of GK-12: Sensors! and aims to continue the effort to strengthen the STEM pipeline into higher education and ultimately academia and industry.

Work In Progress – Integration of Sensors into Middle School Classrooms

Joe Arsenault[1], Stephen Godsoe[2], Constance Holden[3], John Vetelino[4]

Abstract - **The University of Maine (UM) with support from the National Science Foundation (NSF) is involved in an outreach effort to introduce sensor science and engineering into Maine secondary school curricula. Graduate students in sensors, a high profile UM research area, are partnered with secondary school teachers to integrate sensors into their classrooms and to serve as career role models. The goal is to motivate students to pursue science and engineering disciplines and associated career paths. The primary mechanism for establishing direct contact with schools is a sensor-oriented UM-NSF Research Experience for Teachers (RET) program. Prior to the 2004-05 academic year, the effort was targeted at high schools. Recently, however, the focus has been middle schools. In this paper, the program organization, the motivation for focusing on middle schools, the mechanism used to introduce GK-12 *Sensors!* into middle schools, 2004-06 activities and future work are presented.**

Index Terms - GK-12, Middle School, Sensors.

BACKGROUND & OBSERVATIONS

GK-12 *Sensors!* at UM is an NSF-funded program in its fourth year placing graduate students whose research involves sensors in secondary schools. The main goal of the program is to convince secondary school students to pursue science and engineering disciplines and careers. When initially funded, the program focused on introducing sensors into high-school (grades 9-12) curricula using sensor modules developed by high school teachers and GK-12 *Sensors!* fellows. However, in the last two years the program has increasingly recognized the importance of middle school integration [1]. During the past year, GK-12 *Sensors!*, as part of its successful proposal to NSF for renewed funding, established grades 6-8 as the primary focus for initial curricular integration.

In grades 9-12, GK-12 *Sensors!* assumed a uniform flexibility of student interest across disciplines. What was observed however during the first two years of the effort was increasing inflexibility of interest with grade level. By grade 12, significant changes in a student's academic or career interests were unlikely; instead, a small shift in interest (e.g. from chemistry to chemical engineering) was noted. Student feedback suggested that by grade 11 most students are focused toward aligning their personal interests with declared academic and career aims. While ninth and tenth graders may be less focused relative to educational decisions determining career paths, the aspirations of college-preparatory, vocational-technical, and general studies track students varied significantly. These curricular differences and the social significance placed on these differences appeared to affect the degree to which non-college preparatory students were willing to consider pursuing STEM disciplines. Both career predetermination and high-school academic tracks generally limited the GK-12 *Sensors!* program efforts to convince grade 9-12 students to consider science and engineering opportunities.

In contrast, wide-ranging student curiosity and interests are promoted as part of the grades 6-8 educational efforts, which emphasize personal awareness based on social contexts while promoting emergent higher-level cognitive functionality. Students are encouraged to explore career possibilities as avenues for determining their future educational plans. Social stratification is not predicated on rigid self-identifications based on career interest/development, nor are single-grade classes divided into academic and non-academic oriented achievement tracks as they are in high schools. As a result, students in grades 6-8 may be more strongly influenced by the GK-12 *Sensors!* program.

Many of the students in participating GK-12 *Sensors!* schools live in rural, economically depressed regions of central Maine and potentially represent the first generation of college attendees for their families. Establishing a middle-school presence is particularly important to encourage these students to follow an educational path leading to an engineering or science career. This is particularly true for females, who are currently underrepresented in engineering and science related professions. The middle school therefore serves as a window of opportunity for male and female science and engineering role models (GK-12 fellows) to convince students who may initially have no interest in STEM subject matter to pursue science and engineering pathways.

PROGRAM STRUCTURE

The people involved in GK-12 *Sensors!* currently are the Principal Investigator (PI) (John Vetelino), two co-PIs (Stephen Godsoe and Constance Holden), a program manager (Joe Arsenault), ten fellows working with more than two dozen middle and high school teachers, and a UM program evaluator who works with program participants to develop instruments for measuring program effectiveness. Each fellow

[1] University of Maine, joe.arsenault@umit.maine.edu
[2] Bangor High School, segodsoe@msn.com
[3] Department of Spatial Information Science and Engineering, University of Maine, constance.holden@umit.maine.edu
[4] Department of Electrical and Computing Engineering, University of Maine, vet@eece.maine.edu

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is assigned to at least one teacher, with whom s/he works throughout the school year. Each fellow spends ten hours per week with her/his teacher developing and implementing learning modules into the curriculum.

The consensus among 2003-04 participants suggested that the greatest impact on grades 6-8 students, especially females, can be achieved by using appropriate role models to introduce sensors into middle school curricula. GK-12 *Sensors!* subsequently began pursuing interactions with teachers at the middle schools associated with participating high schools. In 2004-05, GK-12 *Sensors!* expanded its efforts into new school systems by targeting middle schools. The 2005-06 program objectives refocused initial curricular integration on grades 6-8, seeking thereafter a grades 6-12 continuity of presence. As of the 2006 spring, the effort has established a presence in seven of eight participating systems. Student interest established at the middle-school level can be cultivated and reinforced throughout high school. The presence of a GK-12 *Sensors!* fellow becomes a normative aspect of STEM (and social studies) classroom dynamics.

PROGRAM PARTICIPATION MECHANISM

Since 2004 a UM NSF RET program has been the primary mechanism for establishing a direct contact with schools. Up to ten middle and high school teachers each summer are awarded eight-week fellowships at UM to be involved in cutting-edge research in sensor theory, design, fabrication, testing, and/or applications.

Teachers interact daily with faculty, senior researchers, graduate students, GK-12 *Sensors!* fellows, and NSF Research Experience for Undergraduates (REU) students in the UM Laboratory for Surface Science & Technology (LASST). The RETs are involved in research on biosensors, chemical sensors, and fluid-phase sensors, and become familiar with state-of-the-art sensor-related science and technology facilities and neighboring sensor businesses. RETs also enroll in a course entitled *Introduction to Sensors*, which presents the theory and applications of various types of sensors, for which they receive academic and recertification credit. RETs work in concert with GK-12 fellows developing possible modules to be introduced into high and middle school curricula. The summer program concludes with the August Summer Workshop, where RETs share both their summer research experience in formal presentations and their proposed modules. All RET participants become GK-12 *Sensors!* cooperating teachers, continuing working relationships established during the summer RET program with GK-12 fellows.

2004-06 ACTIVITIES SUMMARY & FUTURE WORK

During the 2004-05 academic year, GK-12 *Sensors!* was introduced to an estimated 650 grades 6-8 students in 45 classes in six area middle schools. The 2005-06 program expanded to nine schools, impacting more than 850 students in 58 classes. To date, the infusion of sensors into middle school curricula has benefited courses in life science, environmental science, computer science, integrated science, animal and human biology, mathematics and social studies. Many of the sensor modules involve the human body, hydrogen cars, robots, toothpick bridges, the home and community, and the International Space Station's EarthKAM. GK-12 *Sensors!* also organizes tours to UM to expose students to LASST, the advanced wood composites, geographical information, and marine sciences laboratories. Since 2004 more than 550 students have visited UM's high-technology laboratories.

Recent grades 6-8 surveys of 120 students indicate significant positive impact. 87% of respondents felt the GK-12 fellow and program helped them learn subject matter. 58% felt more confident about subject matter learned through GK-12 *Sensors!* modules, and 56% liked the subject matter more as a result of GK-12 interaction [2]. Longitudinal tracking of grades 6-8 cohorts will determine how self-reported student aspirations are impacted throughout high-school matriculation.

During the academic year 2005-06, GK-12 *Sensors!* has also had an effect on pre-middle-school students. "Sam the Ram," an emergency preparedness education project involving GK-12 *Sensors!* and Bangor High School (BHS), targets grades 2-5. In a sequence of presentations and activities, students learn about emergency preparedness from BHS mascot, Sam the Ram, and his 'helpers'. Each presentation includes sensor technology and raises the awareness of career opportunities related to the topic of consideration. These grades 2-5 students will proceed to Bangor area middle schools, in which GK-12 *Sensors!* has established integration of sensors into the curricula. Grades 6-8 survey instruments will be designed to register the influence of primary grade program interaction. Further indications of impact will be solicited during biennial middle-school teacher focus groups.

Additionally, an experienced GK-12 *Sensors!* fellow is interacting with the Maine Discovery Museum (MDM), located in downtown Bangor, ME, developing a large-scale interactive sensors-based learning module appropriate for ages 5-14. MDM, the largest children's museum in the northeastern US north of Boston, has seven interactive exhibit spaces on three floors. Scheduled for fall 2006 implementation, GK-12 *Sensors!* will achieve significant exposure with parents and children from throughout central and northern Maine, including area schools where efforts are currently active.

GK-12 *Sensors!* participating schools and community agencies are discussing criteria and methods for determining the program's footprint and community impact.

ACKNOWLEDGEMENT

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Work in Progress - Evaluation of the University of Maine GK-12 Sensors! Program

Brian E. Doore[1], Joseph Arsenault[2], Constance Holden[3], Stephen Godsoe[4], John Vetelino[5]

Abstract – **Findings from several years of participant feedback about the NSF sponsored GK-12 Sensors! program at the University of Maine are described. The program places graduate Fellows in local K-12 classrooms, with the goal of encouraging students to consider science, technology, engineering, and mathematics professions. Three broad themes are discussed: communication, preparation, and "fit." These factors determine the success of GK-12 Fellow placements, as shown by student and teacher evaluations, Fellow satisfaction, and classroom evaluations. Successful placements strengthen program implementation and status in participating schools while marginal placements can negatively affect both teachers and students and erode support for the GK-12 initiative.**

Index Terms – Communication, Project Evaluation, Instructional Pedagogy, Participant Feedback.

INTRODUCTION

Since 2002, the University of Maine (UM) has placed engineering and science graduate Fellows pursuing sensors research into local K-12 classrooms[1]. Supported by a National Science Foundation GK-12 grant, this program uses sensors as a vehicle for encouraging middle and high school students to pursue science and/or engineering career paths. To date, few of the many GK-12 initiatives active in the U.S. have reported on what works and what does not work in these programs. In this paper conditions under which a GK-12 program can be successful, barriers to success at the K-12 and post-secondary levels, and strategies for addressing these barriers are examined. The evaluation uses participant survey data, focus groups, interviews, and direct observations collected by an external evaluator. In addition, focus groups of participating students reveal ways GK-12 Fellows impact students' career aspirations. Preliminary findings suggest that three factors determine whether a Fellow succeeds: communication, preparation, and "fit."

METHODOLOGY

This project's evaluation uses a mixed method design of surveys, interviews, focus groups, and observations. Student, teacher, and Fellow surveys are designed to measure program goals using a combination of Likert-style ratings and open-ended responses. Questions for focus group sessions are derived from patterns of survey responses. For example, when communication emerged as an issue for several Fellows, this theme was addressed in detail during the ensuing focus group session. The classroom observation protocol is derived from Horizon Research's *Into the Classroom: Observation and Analytic Protocol*[2]. Each classroom observation also includes a time sample analysis to rate students' observable engagement with a lesson. Themes of communication, preparation, and "fit" emerged as accurate descriptors of the overall pattern of participant responses.

K-12 STUDENT RESPONSES

We first consider K-12 student perceptions of Fellow in-class impact, to provide perspective while describing factors determining Fellow success. K-12 students are surveyed at the end of each year. Results indicate a favorable response towards the program. During 2005 and 2006, a total of 368 students returned questionnaires rating the effectiveness and impact of the GK-12 Fellow(s) in their classrooms. Of responding students, 90.2% rated the Fellows' role in the classroom as *Quite Helpful* or *Very Helpful.* Similarly, 47.8% reported being *More Interested* in studying STEM because of the GK-12 Fellows. An additional 28.3% were already *Very Interested*, leaving only 4.2% who were *Less Interested* because of the Fellow. (18.8% indicated they were *Never Interested* and that hadn't changed.) When asked how the Fellow had impacted their confidence, 65.8% of student respondents had become *More Confident* as a result of the Fellows' in-class work. A handful -- 2.7%, were *Less Confident.* Finally, students indicated the degree to which they *Liked the Subject* in which the GK-12 Fellow worked. Again, 54.9% of responding students indicated they *Liked the Subject More*. Another 27.0% *Always Liked the Subject* while 12.6% *Never Liked the Subject*. In sum, students' responses to the post-program surveys suggest that Fellows make a substantial impact in the classroom.

FELLOW – TEACHER – PROGRAM COMMUNICATION

Each year, Fellows are asked to provide critical feedback to improve the program. To date, almost all Fellows mention communication as a significant obstacle to success. This includes communication between program staff and Fellows, cooperating teachers and Fellows, and program staff and

[1] Brian Doore, Program Evaluator, Center for Research and Evaluation, University of Maine, Orono, ME 04469 brian.doore@umit.maine.edu
[2] Joseph Arsenault, Department of English, University of Maine, Orono, ME 04469 joe.arsenault@umit.maine.edu
[3] Constance Holden, Department of Spatial Engineering and Information Science, University of Maine, Orono, ME 04469 holden@sie.maine.edu
[4] Stephen Godsoe, Bangor High School, Bangor, ME 04401 sgodsoe@bangorschools.net
[5] John Vetelino, Department of Electrical and Computer Engineering, University of Maine, Orono, ME 04469 vet@eece.maine.edu

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cooperating teachers. Fellows' comments reflect their concerns about communication:

Better communication between the P.I.'s and the Fellows. It is helpful to know what is expected from us as far in advance as possible, rather than finding out we must submit something almost immediately. (1st year Fellow)

...it would be nice to get some feedback regarding our activities in the schools and the modules we submit. Knowing whether these [modules] are thought to be good or bad, so we can improve them next time. (1st year Fellow)

As a group, cooperating teachers identified similar communication issues, as evidenced by the following comment:

I think what we need is a CLEAR outline of what is expected of the teachers, and the GK-12 fellows. (Teacher)

PREPARATION & SUPPORT

GK-12 Fellows do not typically have extensive experience teaching, planning lessons, or presenting. As a result, there are substantial disparities between Fellows' performances in classrooms. The following synopsis highlights several issues:

The fellow began the lesson after the bell, but had difficulty getting the equipment to work. 20 minutes later the fellow began a lesson that few if any of the students had prior knowledge in. Following the 15 minute lesson, the 20 students began work, using the 5 working computers. One group completed the first part of the lesson before the bell rang, but the other 17 students were off task, text messaging and talking. By the end of the lesson, the Fellow was sweating profusely and appeared visibly distraught. The teacher sat at a desk grading papers during the entire class.

Every teacher has bad days, but inadequate support and preparation characterizes the situation described above. Fellows need support from cooperating teachers. In exemplary placements, teachers and Fellows share responsibilities. Teachers usually handle classroom management, coordinate transitions between activities, and help redirect off-task students. In turn, exemplary Fellows have thoroughly prepared materials, rehearsed presentations, and anticipate what might go awry. The program can support teachers and Fellows by requiring detailed lesson plans, conducting periodic observations of Fellows' lessons, and providing targeted professional development during summer and school vacations. Natural talent plays a role in effective instruction, but preparation and support are far more important. GK-12 programs must help Fellows and teachers develop these skills.

"FIT" BETWEEN FELLOWS AND TEACHERS

Several fellows discussed the importance of a good relationship with a cooperating teacher, which they referred to as getting a good "fit." As fellows described the qualities of this fit, four common factors emerged. First, the teacher has to want the Fellow in the classroom. Fellows described situations where a teacher agreed to participate because s/he was told to. Second, fellows and teachers need to establish the roles they will play. Fellows describing successful placements also described the roles of teacher and Fellow. Third, Fellows who perceived their placements to be more "successful" were keenly interested in working with students. They also described teachers who were also excited to teach and enjoyed the students. Finally, Fellows talked about the "chemistry" between Fellow and teacher. The following quote is typical of their thoughts about Fellow-teacher relationships:

I've worked with several different teachers and to me the experience depends greatly on just the chemistry between me and the teacher. For me the subject area isn't as important as the personality of the teacher. (4th year Fellow)

Teachers echo this sentiment:

...with the right personality it [the GK-12 placement] *is going to be fine, but last year caused me to just back off and say 'That's not a personality I think I'm going to be able to come to a professional, congenial, agreement with.' This year my Fellow and I work together seamlessly.* (Teacher)

RECOMMENDATIONS

The pattern of responses to qualitative and quantitative evaluation suggests this GK-12 program focus on three elements: Communication, Pedagogy and Fit. The following provide a starting place for this and other GK-12 programs.

- Establish regular, structured written and verbal communication between program staff, Fellows, and cooperating teachers
- Identify lead teachers at each school that will train, mentor and evaluate Fellows and cooperating teachers
- Create a summer program that brings teachers and Fellows together to establish working relationships, identify similarities and address potential conflicts

CONCLUSION

The success of GK-12 Fellow placement can be increased through effective preparation and communication, but cannot be assured until a proper "fit" is established between Fellow and teacher. This "fit" is established only after Fellows and teachers have had an opportunity to work together. This supports the need for programs emphasizing Fellows-teacher contact and communication. Such opportunities allow GK-12 programs to monitor and adjust Fellow-teacher pairs and maximize successful placements.

ACKNOWLEDGMENT

This project was supported by National Science Foundation Grant No. 0538457.

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GK-12 Sensors!
Evaluation Report: 2006-2007

Prepared by:
Brian E. Doore
Center for Research and Evaluation
College of Education and Human Development
University of Maine
July 31, 2007

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Note : A word about the format of this report.

Bold print indicates a section heading.
Bold italics indicate a subheading.
Plain italics indicate a survey question, survey scale or question asked by the evaluator.
Plain text indicates the report body.
Plain text in Arial Narrow indicates a participants' direct quote.

Section 1: Overview of the Project

The GK-12 Sensors! program is designed to bring selected doctoral students in engineering together with local area middle and high school teachers. The project is funded through the National Science Foundation and is related to two concurrent projects: Research Experience for Undergraduates (REU) and Research Experience for Teachers (RET). The intention of the GK-12 program is for Fellows to share what they have learned in their research experience and studies in local middle and high school classrooms. During the 2006 - 2007 school year, 13 Fellows worked with 21 local science teachers, 39 classes and approximately 550 students. Two Fellows finished their awards in December of 2006 and one new Fellow began in February of 2007.

The GK-12 Sensors! project has stated goals of bringing approximately 10 Fellows per year to the University of Maine to work with faculty members with backgrounds in biological, civil, chemical, computer, electrical, environmental, mechanical, and spatial engineering as well as physics. The Fellows' thesis topics and designs varied from participant to participant, but all included the use of sensor technologies as a central component.

Many of the participating classroom teachers in the GK-12 Sensors! project also take part in the RET project by working with mentors from the University of Maine during the summer. In this experience, teachers are able to experience firsthand the kinds of research opportunities and challenges experienced by Fellows on a day-to-day basis.

The survey and focus group instruments described in this report were designed to ascertain Fellows', teacher-participants', and faculty advisors' attitudes and beliefs about the degree to which the GK-12 Sensors! experience met the project's objectives. The Fellow observations

were designed to identify exemplary science teaching methods and rate each Fellow's in-class performance against best practices in science & math education.

Section 2: Evaluation Design

Pre- and post- program surveys of participants (Fellows, K-12 teachers, K-12 students, University faculty) attitudes were conducted during the 2006-2007 academic year, and a follow up focus group was conducted with the Fellows in April of 2007 to determine the fidelity and effectiveness of program implementation. Each questionnaire consisted of selected (Likert scale) and constructed response questions aligned to the stated grant objectives. In addition, respondents were provided multiple opportunities to give extended verbal and written responses reflecting their impressions of various aspects of the GK-12 experience. Questionnaires were administered at the beginning of the school year and again in May of 2007. These were completed in private and returned via the computer directly to the evaluator. Responses to the survey were then entered into a spreadsheet by a graduate student and accuracy was verified by the research associate directing the evaluation of this project.

The Fellows were also observed teaching in their classrooms. Their lessons were rated using Horizon Research's "Inside the Classroom" protocol. These observations were aggregated across Fellows to identify specific areas of strengths and needs for the program to consider. No individual Fellows are identified in this report.

The results of these evaluation activities are by nature qualitative – any attempt to generalize the meaning of the frequencies, percentages or differences is both unwise and inaccurate. Instead, the pattern of comments and responses must be considered in their totality and interpreted as the opinions and perceptions of the responding individuals only. Interpreted this way, these responses give valuable insights into the impacts of the project on participating students, teachers, faculty, and Fellows.

Evaluation Schedule

The table below details the nature and frequency of the different evaluation instruments:

Evaluation Instrument	Administration Schedule
Survey of Fellows' attitudes and expectations	October 2006, May 2007
Survey of cooperating teachers' attitudes and expectations	October 2006, May 2007
Observations of Fellows' lessons	October 2006, May 2007
Survey of students served in Fellow's middle and high school classes	October 2006, May 2007
Survey of Cooperating Faculty Members	May 2007
Focus group with Fellows	May 2007
Focus group with Students	May 2007

Section 3: Fellow Responses Pre-program Survey

In February of 2007 one new Fellow was surveyed and that response was combined with the previous Fellow responses to determine the Fellows' overall initial impressions of the project with eight complete surveys were returned. Questions addressed Fellows' perceptions of the utility and value of the GK-12 program for students, schools, cooperating teachers, and themselves.

Four Fellows (50%) indicated they were pursuing Ph.D. programs, while four (50%) others were enrolled in Master's of Science programs. When asked if the GK-12 experience had encouraged them to pursue a Ph.D., five of the eight (62.5%) responding Fellows indicated they were more likely to pursue their doctorate. Two others (25%) indicated they had always intended to get their doctorate, while only one (12.5%) indicated he/she still intended to stop with his/her M.S.

When asked about their level of interest in teaching, Fellows indicated the GK-12 experience had made them more interested in teaching, but not necessarily in becoming a public school teacher. While six (75%) of the eight respondents indicated high levels in interest in teaching, none (0%) of the responding Fellows said he/she wanted to become a high school teacher.

While the GK-12 experience did not seem to impact responding Fellows' aspirations to become public school teachers, they indicated the experience had improved their teaching skills substantially, and all eight (100%) respondents expressed interest in teaching at the university level. In addition, seven (88.5%) of the seven respondents felt they had improved their presentation skills, and all eight (100%) felt they had improved communication skills. Six (75%)

of the seven responding Fellows also gained some understanding of cooperative learning strategies.

Five of the six (83%) respondents indicated they had made a positive impact on public school students' understanding of Science, Technology, Engineering and Math (STEM), while one respondent indicated they had no impact on students' interest in these areas. When asked how their Fellowship had impacted their thesis, six of the eight (75%) respondents said it *had not* helped, one (12.5%) indicated it *had* helped, and one (12.5%) respondent was not sure.

When asked about who was most helpful to them, responding Fellows indicated that they received the most help from cooperating teachers and public school students. By contrast, respondents got relatively little help from textbooks, faculty members, and other Fellows. There was one exception to this pattern – one Fellow received the most help from a University faculty member.

The final question on the pre-program survey asked Fellows to rate how rewarding their experience with the GK-12 program had been thus far. All eight (100%) respondents indicated it had been a *rewarding* experience, and six of the eight (75%) felt it has been *very rewarding*. Detailed tables indicating the frequencies of responses follow.

Quantitative Results GK-12 Fellows Survey Fall 2006

		N	Percent
What is the highest level graduate degree you are currently pursuing?	M.S.	4	50%
	Ph.D.	4	50%
	Other	0	.0%

		N	Percent
Please indicate how much, if at all, your experience so far as a GK-12 Fellow has affected your interest in pursuing a Ph.D.	I enrolled with the intention of getting a Ph.D., and my intention has not changed	2	25%
	Much more likely to get a Ph.D. now	3	37.5%
	Somewhat more likely to get a Ph.D.	2	25%
	Somewhat less likely	0	.0%
	Much less likely	0	.0%
	I intended to stop at a M.S. degree, and my intention has not changed	1	12.5%

		N	Percent
Before becoming a GK-12 Fellow, had you ever considered becoming a middle or high school teacher?	Yes	5	62.5%
	No	3	37.5%

		N	Percent
How interested in teaching were you before this semester?	Very interested	4	50%
	Somewhat interested	2	25%
	Only a little interested	2	25%
	Not interested	0	.0%
How interested in teaching are you now?	Very interested	6	75%
	Somewhat interested	1	12.5%
	Only a little interested	1	12.5%
	Not interested	0	.0%

		N	Percent
Are you interested in becoming a high school teacher?	Yes	0	.0%
	No	6	75%
	Maybe	2	25%

		N	Percent
Are you currently working toward obtaining a teaching certificate?	Already have a teaching certificate	0	12.5%
	Yes	0	.0%
	No	2	12.5%
	No, not planning to get one	6	75%

		N	Percent
Do you plan to teach at the college or university level?	Yes	2	25%
	No	0	.0%
	Not sure	6	75%

		N	Percent
To what extent did your experience as a GK-12 Fellow affect your teaching skills this semester?	Greatly improved them	4	50%
	Somewhat improved them	4	50%
	They declined	0	.0%
	They are quite good already, and I did not see any more improvement	0	.0%
	They may need improvement, but this experience did not have any impact	0	.0%

		N	Percent
Has being a GK-12 Fellow helped you make better professional presentations?	Yes	6	75%
	No	0	.0%
	Not sure	2	25%

		N	Percent
Did being a GK-12 Fellow improve your communications skills?	Yes	8	100.0%
	No	0	.0%
	Not sure	0	.0%

		N	Percent
Did your experience this year as a GK-12 Fellow affect your familiarity with active/cooperative learning techniques this semester?	I was quite familiar with them before, and that did not change	1	12.5%
	I became much more familiar	1	12.5%
	I became somewhat more familiar	5	62.5%
	I do not know what is meant by active and cooperative learning techniques	1	12.5%

		N	Percent
In general, how did your involvement as a GK-12 Fellow affect your students' motivation to study science, technology, engineering and mathematics?	Greatly improved their motivation	2	33%
	Somewhat improved it	3	50.0%
	Had little impact on it	1	16.5%
	Somewhat reduced it	0	.0%
	Greatly reduced it	0	.0%
	Do not have any classes at this level	0	.0%

		N	Percent
Has being a GK-12 Fellow enhanced your thesis research this semester?	Yes	1	12.5%
	No	6	71.4%
	Not sure	1	12.5%

Which of the following groups has been most helpful in your GK-12 experience?

		n	percent
University faculty members	Most helpful	1	12.5%
	Somewhat helpful	0	.0%
	Helpful	1	12.5%
	Marginally helpful	5	62.5%
	Least helpful	1	12.5%

		n	percent
High school / Middle school teachers	Most helpful	4	50%
	Somewhat helpful	4	50%
	Helpful	0	.0%
	Marginally helpful	0	.0%
	Least helpful	0	.0%

		n	percent
Other GK-12 Fellows	Most helpful	0	.0%
	Somewhat helpful	0	.0%
	Helpful	4	50%
	Marginally helpful	4	50%
	Least helpful	0	.0%

		n	percent
Literature and textbooks on instructional techniques	Most helpful	0	.0%
	Somewhat helpful	0	.0%
	Helpful	2	25%
	Marginally helpful	0	.0%
	Least helpful	6	75%

		n	percent
High school / Middle school students you have encountered	Most helpful	3	37.5%
	Somewhat helpful	4	50%
	Helpful	1	12.5%
	Marginally helpful	0	.0%
	Least helpful	0	.0%

		N	Percent
Overall, this semester, my experience as a GK-12 Fellow has been	Very rewarding	6	75%
	Somewhat rewarding	2	25%
	Neither rewarding nor disappointing	0	.0%
	Somewhat disappointing	0	.0%
	Very disappointing	0	.0%

Fellows' Pre-program Survey Summary of Qualitative Responses

If you are interested in teaching, what subjects would you like to teach?

- Social Sciences
- Physics, Mathematics, History
- Physics, Mathematics, Science
- If at the college/university level, I would like to teach GIS-Geographic Information Systems.
- Physical Sciences(Physics, Chemistry, etc)
- Physical Sciences, Physics & Chemistry
- Physics, Chemistry, General Science

How did your GK-12 experiences enhance your thesis research?

- I have included more spatial relation components to my thesis research
- It broadened the way I looked at presenting material

How did your GK-12 experiences NOT enhance your thesis research?

- My thesis research area has little relevance to the teaching I do, although I was able to mention/discuss it during one of my presentations to the 6th graders. The time commitment to GK-12 also makes finding time to work on research a little more difficult.
- Very unrelated and has actually taken time from my research
- It has taken time out of my research schedule

What has surprised you about the GK-12 program and your teaching experience so far, either positively or negatively?

- The amount of "drama" and bureaucratic nonsense public school teachers have to deal with on a daily basis.
- I've been surprised by how different it is to develop first lessons on a regular basis, it can be a very time-consuming process.
- It is much easier to influence younger students (8th grade) than older ones (juniors-seniors). I feel like I'm making more of a difference this year being with younger students. This is a very positive aspect.
- I was pleasantly surprised by my experience with younger students, 6th graders especially. They are so enthusiastic and excited about having you in the classroom, especially doing activities. They are eager to participate in discussions as well. I didn't know I would enjoy working with students at all ages so much when I was just starting. It's been fun!
- I'm surprised how much I've enjoyed working with the middle school students. Last year I had a great time at the high school level but this year is far more fun and far more rewarding.
- The biggest surprise is the lower aspirations at students in one school district as compared to another

What suggestions do you have for improving the GK-12 program?

- Better communication between all of the participants.
- Get some sensors the GK-12 Fellows can share between the schools. Some of the schools have very few sensors and it takes a long time to get the sensors through the state's borrowing program. Sometimes it's too late once they come-the activity you want to do has passed by in the curriculum. Having them readily available would be very helpful.
- Expecting us to develop two new modules in one semester was not a good idea. Two modules per year is more reasonable.
- More focus on communication across all levels

Section 4: Fellow Responses to Post-program Survey

A total of eleven complete (100% return rate) questionnaires were returned for the May 2007 post-program survey. This survey was a parallel form to the pre-program survey, and while the overall pattern of participants' responses is similar, there are several important differences worth highlighting. Respondents provided similar responses to questions about their educational plans, and reasons for attending graduate school at the University of Maine.

Six of the 11 Fellows indicated they were working towards a Ph.D. while 5 were working towards their Master's degree. Four of these 5 respondents earning a Master's degree indicated they were more likely to pursue their Ph.D. as a result of their involvement as a GK-12 Fellow; only one respondent said they had originally planned to earn a Master's and hadn't changed their mind.

When asked if the GK-12 experience had changed their interest in teaching, responding participants showed increased interest which they attributed to the program. The majority of respondents felt this experience had increased their interest in teaching. In particular, 6 of the 10 Fellows who answered this question were more interested in becoming a middle or high school teacher. Paradoxically, when asked if they were interested in obtaining a teaching certificate, only 1 of the respondents indicated he/she was planning to become certified to teach public school. These confounding statements are difficult to interpret with certainty. They may indicate an intellectual affinity with the concept of teaching but a lack of real interest in operationalizing that interest through obtaining a teaching license.

It is also unclear whether these individuals may enter university faculty positions at a greater rate. When asked if they planned to teach at the college level, three respondents said *Yes*, one said *No*, and seven said they were *Not Sure*. Given these results, it may be important for

program staff to consider paying special attention to educating Fellows about the benefits and opportunities associated with becoming a university faculty member.

The next question asked participants to evaluate the impact of the GK-12 experience on their teaching skills. Six said they had *Greatly improved them,* three respondents said their teaching skills had *Somewhat improved* and no (0%) respondents felt their skills had *Declined.* Only one Fellow said his/her teaching skills were already very good and had not improved. These results suggest participants had gained a substantial amount of experience and skill as a result of their Fellowship.

When asked how the GK-12 experience had impacted their presentation skills, seven responding Fellows said it had made them better presenters, two said it did not and one was not sure. One Fellow did not mark an answer to this question. One question asked Fellows to comment on their understanding of cooperative learning techniques used in schools. The purpose of this question was to determine if Fellows became more familiar with these kinds of teaching strategies throughout the course of their teaching experience. This did not prove to be the case as similar patterns of response were detected on both the pre and post surveys of Fellows. Because several of the respondents had prior experiences as a GK-12 Fellows, this may have impacted their selections when responding to this question. This issue, in combination with the very small number of participants may impact this pattern of results substantially.

Responding participants were more positive about their perceived impact on students' interest in studying science, technology, engineering and mathematics. All but one of the respondents felt they had a positive impact on the students they worked with, and four individuals indicated that impact had *greatly improved* the student's motivation. Finally, when asked to comment on the impact of the GK-12 experience on their own research activities, five

respondents *Did not* feel their teaching had enhanced their thesis work. Three Fellows felt it *Did enhance* their thesis work, and three others were unsure of the impact. This pattern is consistent with the fall survey, and the Fellows' explanation of why it did not enhance their work was also similar. Many Fellows indicated the GK-12 work had taken up substantial amounts of time, leaving them with less time for their own studies, yet saw the value of the Fellowship and the experience as contributing to their overall ability to complete their thesis. The complete set of Fellows' qualitative responses to this question can be found beginning on page 23.

Fellows were also asked to rate the relative "helpfulness" of different groups with their GK-12 experiences. Respondents rated faculty members, high school/middle school teachers, other Fellows, textbooks and middle/high school students. Not surprisingly, Fellows rated cooperating teachers as the most helpful. Interestingly, the Fellows rated students as the next most helpful group. Respondents indicated other Fellows were generally *Helpful* to them, but not *Quite helpful* or *Most helpful*. Most Fellows found textbooks and faculty members to be only *Marginally helpful* or *Not helpful*. This raises two important points: first, students are a largely unidentified source of support to Fellows; and second, faculty members are not perceived as supporting students in this experience. Program staff should consider what sources of support and encouragement they expect for Fellows and adjust program expectations and professional development accordingly.

When asked how their GK-12 experience impacted their desire to stay in Maine, Fellows' responses were either positive or neutral. Seven respondents have always intended to stay in Maine, and one other said the experience made them more likely to stay. One respondent said he/she had made no change of plans of where they would work, one indicated they were less

likely to stay in Maine and the last respondent never planned to work in Maine and that decision had not changed.

Finally, Fellows were asked to comment on their overall experience with the GK-12 program. All but one of the respondents indicated it had been a rewarding experience for them. This finding is important in light of the constructive criticism provided by responding participants in other parts of this survey. While participants pointed out specific needs the program should address, they were overwhelmingly positive about their experiences working with teachers and students and felt they had gained a great deal from the experience. The results of both the spring focus group as well as the comments on the qualitative portions of this survey shows this pattern clearly – Fellows have specific suggestions to improve things, but overall, they have found the experience very satisfying and rewarding. A detailed list of tables showing the pattern of responding participants' answers can be found starting on page 23. An overview and full text of the focus group can be found beginning on page 34.

Section 5: Fellows' responses to post program survey: Quantitative responses

		Count
What is the highest level graduate degree you are currently pursing?	Master's of Science	5
	PhD	6

		Count
What will be the title of your graduate degree?	MS Electrical Engineering	4
	PhD Electrical Engineering	3
	PhD Chemical Engineering	1
	PhD Materials Science (Interdisciplinary)	1
	MS Spatial Information Science and Engineering	1
	PhD Ocean Engineering	1

		Count
Did getting a GK-12 fellowship influence your decision to enroll in graduate school at UMaine?	Yes	8
	No	3

		Count
When you enrolled in graduate school at the University of Maine were you planning on getting a Ph.D.?	Yes I enrolled in a Ph.D. program	4
	Yes, I enrolled in a MS program and plan to continue to a Ph.D.	2
	Perhaps, I am enrolled in a M.S. program and may continue to a Ph.D.	4
	No, I plan to stop with a M.S. degree	1
	Not sure -- I will wait until after the M.S. degree to decide	0

		Count
How much did your experience as a GK-12 fellow has affected your interest in pursuing a Ph.D.	I enrolled with the intention of getting a Ph.D. and my intention hasn't changed	6
	Much more likely to get a Ph.D.	2
	Somewhat more likely	2
	Somewhat less likely	0
	Much less likely	0
	In intended to stop at a M.S. degree and my intention hasn't changed	1

		Count
Before becoming a GK-12 fellow, had you ever considered becoming a middle or high school teacher?	Yes	3
	No	8

		Count
How has your experience as a GK-12 fellow affected your interest in teaching at the middle or high school level?	I was sure I was going to teach and that hasn't changed	0
	Much more interested	2
	Somewhat more interested	4
	Somewhat less interested	0
	Much less interested	0
	In never expected to teach and that hasn't changed	4

		Count
Are you currently working toward obtaining a teaching certificate?	Already have a teaching certificate	1
	Yes	0
	No, but plan to start soon	1
	No, not planning to get one	9

		Count
Do you plan to teach at the college/university level?	Yes	3
	No	1
	Unsure	7

		Count
To what extent has your experience as a GK-12 fellow improved your teaching skills?	They were very good before, and they haven't changed	2
	Greatly improved	6
	Somewhat improved	3
	Declined	0
	They weren't very good before and they haven't changed	0

		Count
Do you think being a GK-12 fellow has helped you make better professional presentations?	Yes	7
	No	2
	Not Sure	1

		Count
Has being a GK-12 fellow improved your communications skills?	Yes	9
	No	1
	Not Sure	1

		Count
Has your experience this year as a GK-12 fellow affected your familiarity with active/cooperative learning techniques?	I was quite familiar with them before and that hasn't changed	2
	Much more familiar	5
	Somewhat more familiar	2
	I don't know what is meant by "active/cooperative learning techniques"	2

		Count
What has been the impact your involvement as a GK-12 Fellow on the middle and high school students in your classes?	Greatly improved their motivation to study STEM	4
	Somewhat improved their motivation to study STEM	6
	Had little impact on their motivation to study STEM	1
	Somewhat reduced their motivation to study STEM	0
	Greatly reduced their motivation to study STEM	0

		Count
Has being a GK-12 Fellow enhanced your thesis research?	Yes	3
	No	5
	Not sure	3

	Mean
University faculty members	3.64
High school and/or middle school teachers	1.18
Other GK-12 Fellows	3.18
Literature and textbooks on instructional techniques	3.91
High school and/or middle school students you encountered	2.55

		Count
How has your experience affected your interest in working (including teaching) in Maine?	Had always planned to work in Maine and that hasn't changed	7
	Much more interested	1
	Somewhat more interested	0
	No Change	1
	Somewhat less interested	1
	Never planned to work in Maine, and that hasn’t changed	1

		Count
Overall experience as a GK-12 fellow	Very Rewarding	8
	Somewhat Rewarding	2
	Neither Rewarding nor Disappointing	1

Section 6: GK-12 Fellows Spring 2006 Post-program Survey:
Fellows' Post-program Survey Summary of Qualitative Responses

How did the award of a Fellowship affect your decision to enroll in graduate school at the University of Maine?

- The GK-12 fellowship provided an attractive monetary benefit to joining the program. Also I have personally had the desire to teach or explore teaching and thought that this was a good fit for me.

- I had been contemplating going to work rather than staying on as a TA at UMaine but GK-12 offers a very generous package which influenced me to stick around

- Without the stipend included with the fellowship I would have stayed with my previous job and not pursued going back to grad school full time at this point.

- By receiving this fellowship it enabled me to support my family's needs and further my education.

- I had planned to leave here when I finished my M.S. program. I decided to stay and pursue a Ph.D. when the GK-12 opportunity was presented to me.

- Since I had a full-time job before I became a fellow I would not have been able financially to enroll in graduate school if it were not for the $30k stipend from the GK-12 program.

- I would not have been able to quit my job and enroll in the masters program as a full time student without getting into the GK-12 program. I had started as a part time graduate student while working full time but it was getting harder to take the graduate classes when they were offered and still meet the demands of my job. This program allows the flexibility I needed and the financial support that was critical to my enrolment in the engineering program of my choice.

- I had funding for research but did not have money for an assistantship so it filled in this void. Also I participated in a similar NSF program the year previous and I really enjoyed it so when I was given opportunity to do it again I jumped at it.

If you are interested in teaching what subjects would you like to teach?

- Science – Physics, Chemistry, and Physical Science
- Math
- Technology
- Science and math
- I would like to teach math and physical science courses.
- Math/ physical sciences
- I was a teacher but decided some time ago that my interest was in research, not teaching at the middle or high school level.
- Chemistry or biological sciences with a food science emphasis

List below up to three teaching modules you substantially used, developed, or modified as a GK-12 Fellow this academic year.

- Popsicle stick bridges
- Water Powered Bottle Rockets
- Electromagnets
- Making Ice Cream (Freezing Point Depression)
- From H to OH (pH Scale and Acids and Bases)
- Science Olympics (Activities that require the students to design and build bridges,
- Developed a module based on the diet coke and mentos fountains as seen on the internet which was a huge success. Another fellow adapted it even more to make it better when he performed it with his classes.
- Intro to Engineering through Bridge Building, Toothpick Bridge Challenge, Intro to Magnetism.
- I developed a module dealing with programming in OpenGL in the computer science class, which is a graphics library that can be used to create very sophisticated graphics. Over the course of a year, I showed the students how to use this library to create a game. There will be a contest at the end of the year to see who has the best game.
- I also developed another module using a computation program called Sci-Lab to develop models of physical phenomena. Over the course of the year, modeling concepts were introduced with the intent that the students could develop physical phenomena of their own choosing. However, due to time limitations and lack of necessary background of the students, the emphasis of developing their own model was dropped. However, mathematical models of two physical phenomena were discussed in depth.
- I also substantially used a module that I implemented last year. This was to understand and build an Adder circuit using discrete digital components.
- Ohms Law Module
- Spectroscope Module
- Fruit Battery Module
- Additional lessons developed to go along with USGS GIS unit on Africa. The USGS lessons were geared more towards physical and environmental topics on the African continent. My lessons incorporated current political and social issues (Looting of Diamonds to fund Insurgencies, HIV/AIDS, Government funding for AIDS relief and prevention, and the numbers of resulting orphans).
- Crime Analysis Unit: Exploratory Spatial Data Analysis of Burglaries (2003-2006) in Bangor, Maine. Full unit.
- Blubber Glove (modified), Fun with Liquid Nitrogen, Egg-drop project (new)
- GPS - a look at how the technology works, how to used this technology and geocacheing
- Future Fuels - A look at possible ways to fuel cars and had students research future fuels pros and cons after watching the Discovery Channel Show Future Cars.
- Phases of Matter and Density – Exploring these topics using common items found in the home

If you used active/cooperative learning techniques that you found to be particularly useful, please note them briefly in the space below.

- We use an inquiry based approach to learning where students are given datasets and parameters for projects. They work in small groups of 2-3 students to determine their questions of interest, gather

additional data needed to answer their own questions, and problems solve various technical and methodological problems along the way.

- This is not a lecture based class and almost all in class work is completed in these small group units.
- Engage the students in the material through written exercises that need to be completed for a grade before the material is presented.
- Reward their efforts using grades.
- Assign a percentage rather than number of points so they don't know how much each exercise is really worth.
- Have a hands-on exercise to reinforce the material.
- Call on students by name to see if the material is being understood.
- Have students explain key concepts so it motivates the inattentive students to pay attention.
- My teacher and I have a good cooperative learning method that helps me learn good forms of being a teacher and how to get across my points and also introduces him to new concepts that we can teach the class. He'll tend to introduce the class to what we are going to do for the day in general then hands it to me and I dive into specifics of the topics and he assists me while I conduct the lab

If you think that your involvement improved the motivation of at least some students to study STEM, please briefly note specific examples or experiences you had that led you to that conclusion.

- I think the biggest impact was the students got to interact with somebody else (myself) who has gone down the engineering path in school. They were able to see that it is possible and can be very interesting.
- I have requested students to provide their home information so that they can be notified of open houses conducted in the Electrical and Computer Engineering Department. Three students enthusiastically provided their information.
- The overall excitement of the class when I'm there is large, I can tell everyone is excited to be there and wants to listen what I have to say.
- A graduating senior spoke enthusiastically to me of obtaining admission to the University of Maine in Mechanical Engineering and getting a job over the summer in that department.
- When students meet me in the hall or in other classes, they ask me, "Are we going to work on circuits today?" They are disappointed when I tell them "no".
- Certain groups of students are so enthusiastic about working on exercises that they complete them even before I have finished explaining the concepts involved.
- I have several accelerated students that want to pursue careers in food science because of activities was have done and tours that we have taken on campus of the food science department.
- At the end of class it is not uncommon for individual students to approach me and express their excitement about whatever we did that day. Also, when I bring students to the UMaine campus for tours of the science facilities it is obvious that the visit is having a huge positive impact on many of the students.
- Because I came in the second half of the year, in Feb I administered my own basic survey to gauge kids' interests in and knowledge of Engineering. Out of about 60 of kids in 3 different classes only 14 students reported having considered Engineering as a possible area of study in college. By the beginning of May, we were trying to estimate how many students were interested in visiting the College of Engineering if we could arrange a trip to campus, out of about 60 students in the three classes between 35-40 students said they were interested in making a visit to campus to find out more about

UM's engineering programs. They specifically asked to talk to undergrad and grad students to get a college student perspective on the various programs. We also had another senior who changed his plans to apply for an undergrad history program and reapplied to the college of engineering. We are unsure at this point if he will be accepted but his interest is a direct reflection of his enthusiasm for GIS, spatial engineering and computers he has gained in this class. I directly relate this improvement in interest and motivation to this class and the teacher's enthusiasm for her students' learning and the content.

- It is difficult to pinpoint examples. However, other teachers have said that students are interested in what I do. I have the impression that I do provide a new way for students to think about what happens in science and engineering.

If you think that your involvement did not improve the motivation of some students to study STEM, or it reduced their motivation, please explain why in the space below.

- Some students still do not appear interested in science and engineering. These students appear to either be more interested in other subjects or place little value on education. More often than not, the students who openly state that they are not interested in STEM are looking for attention and are trying to act out (disruptive behaviors usually accompany these statements).

- There is a class that I teach that has a few students who are so unresponsive that it is hard to judge what they are thinking.

How has your GK-12 experience enhanced your thesis research?

- There's no where else where I could have school and expenses covered with the amount of work GK-12 requires, anywhere else and I would have to work way more hours, which would leave less time for research.
- I have not yet begun my thesis research but I believe my interactions with the students and the teachers will enhance my own learning. The kids have questions they want answered and the teacher is flexible about the ways her curriculum can be covered and I am hoping to use my thesis work to help illustrate concepts and skills along the way so everyone benefits. I also think any time you can share your own learning and research methodology with others (students, teachers, etc.) it brings up questions and ways of thinking you might not have come up with on your own.
- During the course of my teaching, I have been relying heavily on my background to develop modules. As a result of revisiting these concepts, I have been able to make some interesting observations that were not apparent to me earlier. Now, none of these observations are directly applicable to my research, but these "nuggets" of information were interesting enough that they provided me with a better understanding of the concepts involved. My appreciation for these concepts increased significantly.
- Question 22 is hard to answer with a yes or no answer. I have certainly benefited tremendously from the program and perhaps my thesis research has benefited as well. The negative impact on my thesis research due to time limitations is more obvious but this is a consequence that we accept as the price we pay for all the wonderful benefits we enjoy as fellows.
- Being a GK-12 fellow has provided me with a better idea of how the general public thinks of my research. Thus, my research is enhanced because I know better what I need to communicate to the public and what they value.

How has your GK-12 experience NOT enhanced your thesis research?

- The time required to develop, research, and prepare good lessons is time that I am not performing research.
- Teaching the students has nothing to do with my research. There is very little of my research that I can use with the students. If anything GK12 prohibits my research ability because of the time commitment.
- These two piece of my work are in two different fields/areas and there is little to no overlap
- I only perform 2 experiments with students that deal with my research topic.
- Although I think the GK-12 program has been a very positive experience it takes a great deal of time and this significantly detracts from the time I have to work on my research.

What surprised you most about your GK-12 experience?

- That I had no idea how to teach little kids, I thought just having the knowledge was enough but I've learned it takes a lot of skill, quite a bit more difficult than I thought it would be.
- I was surprised by how much I enjoyed working with 8th graders. This year's 8th graders were challenging in that their aspirations were not high, they exhibited low self-esteem, and they were prone to be disruptive. Yet they were very interested in most of the activities that I brought to the classroom.
- I was most surprised by the response of a middle school's principal. She is always polite and friendly, but at the same time she gives me the impression that she doesn't value the GK-12 program very much. However, some of the teachers do appear to value the program and are very supportive.
- The activities and exercises that I had planned required a great deal of class time. I had not expected needing as much time as it took. I was surprised how little time there is if you are teaching only once a week. Also the class periods were only 40 minutes long. This makes it very difficult to introduce concepts, make sure students understand the concepts, and complete an exercise in this time.
- The retention of the students with exposure to material only once is a week is very low. Long term projects that are worked on only once a week are very difficult to accomplish.
- I was a GK-12 fellow previously and I already had a good idea about what to expect from the program.
- How big of an impact a tour of campus can make on students. This was probably one of the simplest ideas, but one of the most effective tools we as fellows/teachers we can have on encouraging students to pursue higher education. The students that came here two months ago are still talking about it at the high school and continually asking questions about campus.
- I think what surprised me most about this past year—my third in the program—is how much newness there still was. How much new material I covered with students, how many new ideas for teaching modules were developed, how many new modules were created, etc. It was a very exciting year.
- I had a teacher that did not want to leave his curriculum and this meant I had to come up with lessons that I was not really that comfortable with. This in the long run was okay and I ended up learning things I didn't know before.
- How little freshmen students in high school know about math and science. It also amazes me how the students don't follow directions at all.
- How short the classes are (40 minutes) and how hard it is to fit in a self contained lesson with all of the necessary features in that time frame. I used to teach in 80 minute blocks and that was much easier. In this setting, everything has to be planned down to the last minute before the bell. Otherwise, you have to be very good at getting the kids going on continuous long term projects and keeping them motivated to work through the entire project.

- I guess I thought there would be more interaction with the other fellows but I realize everyone is just trying to get into their classes, work in their classrooms and develop their lessons. This does not leave much time for extra meetings or idea swapping.

What could be improved about the GK-12 program?

- Make sure the teacher and gk-12 fellow like each other and want to work together, it makes the program way more fun and rewarding.
- I think that a brief session on teaching methodology and pedagogy may be valuable for new GK-12 fellows. This need not be formal but run as the graduate school runs their TA Orientation with current teachers and fellows explaining some of the trials and tribulations of teaching.
- For those who wish to get a teaching certificate so that they could teach in a school after they graduate I believe that this program should in part fulfill the student teaching portion. This would be another nice thing for the fellows to get out of this program. Besides the experience. This would also show up on the transcripts.
- But managerial wise this has been the best year that I have been apart of, finally I think it would be nice if we (meaning the program) get every school we work with to come to campus at least once. Or perhaps get some short summer programs for a few students from each school we work with to spend a week here.
- Have the GK-12 administration work with participating teachers to notify participating administrations of fellow assignments and also follow up with a thank-you and perhaps an annual report.
- Pair new and experienced fellows together and the new fellow can observe the experienced fellow in action during their interactions with students.
- Encourage fellows to sit in on the class a couple days of the first week of class without presenting anything. This will allow the class to become used to the fellow and vice-versa.
- Notify fellows of their assignments with schools and teachers early in the summer so that they can plan modules and meet with the cooperating teachers.
- In order to allow fellows more time for their research I would recommend that fellows do not teach when UMO is not in session (winter break, after the end of the spring semester) with the exception of 1 of the weeks of spring break. This was the policy for the GK-12 program that I was a involved with before the GK-12 Sensors! program.
- So many improvements have been made in the program since my first year as a fellow that I really have nothing to complain about. My only concern is if recommendations for certain changes from individuals' previous "suggestions for improving the program" are taken too far; but that remains to be seen.
- More feedback and advice from program staff on ways to directly impact students' interest in engineering programs based on classroom observations.
- More coordinated opportunities to bring students to campus to visit the College of Engineering program. I brought one student up under special circumstances, he received an outstanding tour and overview of what UMaine had to offer but I would have liked to connect more of my students with the same opportunity. The school system was not terribly cooperative about arranging transportation and student time to make a visit at the end of the year. Because I am new to the College of Engineering I am not connected to the people who promote the college to high school students through different events. It would be great (if this does not already exist) to have more information about the ways the college does this throughout the year.

- It would also be helpful for the college or the GK-12 program to recruit undergrad and grad students to talk with the students and have a list of these folks available to the fellows. In theory the fellows could all commit to talking to each others' classes about their research area and what got them interested in engineering but having some formal process would be even better.
- I would like to be assigned for only 2 teachers, 3 teachers is too many and too many. Then I can really get to know the students better.

Section 7: GK 12 Focus Groups: Overview

In the fall of 2006 and the spring of 2007 GK-12 Fellows met together with the evaluator to discuss the implementation of the program, as well as the Fellows' perceptions of its effectiveness. The each of these meetings began by asking the Fellows to comment on how things were going in general. In both meetings, the Fellows were positive about their placements, their studies and the program in general. Next, the Fellows were asked to comment on specific elements of the GK-12 program. When asked about the communication from the program staff, Fellows noted the frequency, timing, and quality of the communication were much improved over past years of the program. On a related point, they also appreciated having a manual to help guide them.

> …we had a manual at the start of the year and that's something we never had before, the one comment on that is that I don't know if it was emailed to all the teachers, the RET's that were here last year, and they see it and they're like oh this is what's going on at least as a frame of reference. The meetings have been announced in advance more than they were in the past, so that's been good and when modules are due we get a sufficient reminder, when journals are due there's no question. I think it's improved… (Fellow comment from May 2007 focus group meeting)

While Fellows recognized improved communication directed towards them, they simultaneously identified a need for improved communication with the participating schools. In particular, several responding Fellows mentioned communication between the communication and the administration of the schools in which they worked. One Fellow commented:

> It would probably be nice, a technicality, but it might be nice for the program to write to the [school] administration saying you know this is what we're hoping will happen and we appreciate your cooperation and that sort of thing and the hope is that the school's are benefiting from us but it's also nice to do the polite protocol and we're hoping to be here, thank you for your cooperation. My teacher also recommended as the end of the year's approaching it might be nice to receive a letter from the PI's of GK-12 to write to the school board, saying thank you so much for having us this year, we hope to continue again with a few technicalities, thank you can go a long way.

Another area of concern was the schedule of working in schools. While all Fellows indicated the usefulness of the program to them – both in terms of the experience and the

rumination – all respondents said being in the schools was slowing their research. One suggestion to address this concern was to have Fellows follow the University schedule of classes. According to the responding Fellow; this would permit the Fellows to focus on their research in May and June instead of continuing to go into classrooms.

Fellows commented on the value of meeting regularly with the RET's during the summer of 2006. One Fellow noted:

> I'll just say the summer meetings were good. They were good for me.

Another Fellow said:

> I am willing to bet that this summer (of 2006) was really good for the new RET's and the new Fellows, because obviously in the years past, we haven't done that type of thing. I wish something like that had happened when I was a first year Fellow.

Several Fellows talked about the bi weekly journals they submit to the program manager. Some Fellows expressed frustration over a lack of feedback on these submissions. Similar to statements made in the April 2006 meeting, Fellows wished for some feedback on these submissions. For a few of the Fellows, it was unclear whether the program staff read their submissions. Other Fellows thought the program manager read them, but probably not the PI's.

> …one of the comments I've made is of feedback indicating that our stuff has been read would be nice. And I've made that comment last year, and by golly, I've gotten some feedback. Joe normally sends me a little note now. I don't know if he does it for the rest of you.
>
> Yeah, Joe reads things.
>
> But, he sends me a note that lets me know that he read it. He generally says something, that's in the journal itself. So, I do have confidence that Joe reads them.

In addition to talking about the administration of the program, Fellows discussed their experiences working with teachers. Their comments can be categorized under three broad categories: relationship building, content, and timing. While all Fellows felt they had developed

a good working relationship with their cooperating teachers, some Fellows clearly had a more personal connection to their teachers than others. Perhaps not coincidentally, it was these same Fellows who demonstrated the highest levels of performance in the classroom when they were observed in the fall and spring. The following comment reflects some of the complexity Fellows face going into schools:

> But, I think a lot of it depends on the school and teacher…like what I've heard from _____, s/he and his teacher are working very closely together it seems like everyday. The teacher I was assigned to, he's…somewhat dependent on the subject, too, so there's less room for me there. So, when I can't be in his class, my options are either find another class or do nothing. And so…I'm trying to…my first other step is other earth sciences classes and trying to take some of the stuff I do in _____'s class and do in the other classroom, since it's…it requires less time…you get more bang for the buck…less prep time. You prep one module and take it into three or four classrooms, so I mean…you got a lot for that one module. A couple a years ago, I had an eighth grade teacher I worked with where every Friday like clockwork the day was mine to do with what I wanted. And so…if you got that commitment from one teacher then you don't have the time to do much else, but…you know. If you're not going to be one place, you got to be someplace else. You got to….and the impression that I've gotten, we're suppose to make more of these kinda command decisions about how best to carry out the main goal…which is what I understand, promoting science technology engineering mathematics.

In the subsequent discussion, the Fellows discussed the broad variety of ways they worked with teachers: from working solely with one teacher to working with several teachers spread across multiple school districts. The importance of this variety goes beyond describing the number of teachers or classes the Fellow works with – it also directly impacts the way the Fellows are interacting with students. In the classroom observation section, Fellows' lessons are described in detail. Some Fellows follow closely with the curriculum of the teacher, while others (like the Fellow above) go to classes to do a "special" activity. These activities are often only loosely related to the students' current unit of instruction. As a result, students who come into contact with GK-12 Fellows have very different experiences – some find Fellows an integrated part of their classroom, while others experience a "guest presenter." This evaluation does not

cast value judgments on either approach, but stresses the differences each may have on students' learning and motivation.

Recommendations:

- Interview students who have experienced each type of Fellow placement, then analyze the kinds of impacts these students describe
- Consider a compromise position between the schools' schedule and the University's schedule
- Institute a regular form of communication between the program and the schools. This might be vis-à-vis the lead teachers, but might also include a direct contact between the PI's and the schools' administration in the form of a welcome/appreciation letter

September 2006

Note: Evaluator's questions and comments appear in italics.

GK-12 Focus Group Fall 2006 Edited Transcript:

Well it's neat because we had some of the students come here and tour the new student innovation center, which was great because I'm really involved in that, and then also tour how I make the yo-bons and stuff like that, and I think that whole idea of anybody can become an entrepreneur whether it's something in technology, anything, so then that led into their invention convention, and actually I'm doing a writing for the accelerated physics 8th grade, we're doing how to write a grant, so that's going to be a great activity and so they're psyched up about this because some of them, Doughty Middle School cleaned up all of the invention convention, they just won everything, and they're all Doughty students, so some of them want to approach businesses and stuff with their technology or whatever, and I'm going to show them how to write grants that are applicable, so I'm psyched about that, that's a big thing. Just the overall acceptance that science doesn't have to be boring, it can be a lot of fun.

Tell me about the summer. Some of you were working as part of the program this summer. Others weren't. You were supposed to get to do a lot of your research over the summer, but it seemed to me there were several different kinds of things that happened over the summer. If some of you just like to talk about what you perceive the summer was suppose to be and what the reality of the summer turned out to be, and if they were in line or not.

I think our paper work said that we were suppose to spend fifteen hours a week over the summer on GK-12 stuff, and I for one didn't spend anything like that, despite what may have seemed to some like an excessive stuff going on. I think I may have spent maybe three hours on average a week.

And that was mostly in that meeting?

Mostly in the afternoon meetings, which I enjoyed.

We'll get to the meeting itself a little later. What else?

We were late getting our assignments. I wasn't able to do anywhere near as much prep as I really thought and planned to do. And the thing I hadn't realized…one of the big reasons for that…is that the teachers who weren't being paid to be here in the RET program, it was very difficult to get teachers to commit anytime during the summer unless you paid them.

Does that surprise you?

Well, yeah I guess maybe it was naïve of me, but I assumed if you're gonna be working with someone and be in their classroom…it's their classroom, it's their classroom, their career, their kids…that…I didn't think it would be any problem. I didn't see it would be any problem, but yeah it was tough.

On the flip side of that, I mean, I am working with a teacher once a month, and he was in contact with him all summer. We were planning, and he's not even getting money during the school year from the program. So…I mean, there are teachers who are putting in work and not getting paid for it.

I think none of the teachers I'm working with, primarily, are getting any money. ***

I recently found that I don't think any of them have ever gotten any money. This is my third year, and I just figured that out.

Right exactly.

I'm only working for one school district. I found the teachers I work with, very available, during summer, if not in person, at least, by telephone or email.

I feel in hindsight, I don't regret the lack of assignments as much as I did at that time [last summer]...

Why?

Personally, I think that even with the knowledge, the teachers would not have made themselves available for much planning, between their travel plans and reservation of sanity for the summer. I don't know.

So, in that sense having the general work over the summer seemed…maybe it would have been more useful if we could have focused some of that general work with a little more intention … something about what we wanted to do. But, I'm still working out what I'm going to do in some areas and that's certainly been fun, and I think it couldn't have happened during the summer. I think it had to happen in staff meetings and sort of brainstorm in meetings with teachers at the school. Unless they … figured out their kids.

You're working with multiple teachers, right?

Multiple teachers and two schools, yeah.

I thought there was a lot of redundancy in the formal presentation parts of the meetings. In other words, there were teacher formal meetings that we had to primarily talk about later.

We can jump to that now; I just want to make sure we talk about the other topics

I think we must have introduced ourselves and our research seven times. And teachers, I feel they had a lot of early planned formal meetings that could have been better streamlined and could have been kept. We went over all the time…I mean, Vet planned six five minute presentations, and we'd get six twenty minute presentations or whatever it is. There's not been a good attempt made to do what you're trying to do here, of get us to do what we're suppose to do.

What else, from the summer? Just sort of general stuff. I got some specific topics, and placement. These are just issues that I know are issues, so we'll address each of those separately.

In general, in my opinion, I thought that by meeting at least somewhat regularly it kept us focused on what was going on with the school year, where before it was like summer was like, "ok, go do your research". And all of the sudden August comes and it's like, "oh no, GK-12". So, I felt that when the workshop came we were better prepared to…I was better prepared…to focus on it. And I had a really good understanding

of what I wanted to do once the placement was made. And I will post phase that by saying I got it easy because I was actually placed in the same schools I was in the year before, so planning was made much easier.

I am willing to bet that this summer was really good for the new RET's and the new fellows, because obviously in the years past we haven't done that type of thing and I wish something like that had happened when I was a first year fellow.

I wish it could have happened when I was a second year…I'm just glad that it happened last year.

All right. So let me ask you folks that are new to this program. Was the summer helpful? What did you get out of it?

I didn't start til September 1st.

Were any of you here over the summer to just get an overview of the expectations?

Yes, I guess my comment is, the summer session made me more comfortable with what I was going to be doing during the fall, didn't necessarily help me…I wasn't planned for the fall any better than I probably could have been, but I was just more comfortable with the whole program with the way things were done. I mean, the teacher I ended up working with was an RET this summer, although I suppose we could have been planning had we known of the fellow teacher assignments, but even then I'll kind of agree a little bit with Edwin on the not knowing wasn't necessarily a bad thing, because when I went and I actually saw my teacher's classes, completely changed every plan that I had thought in my head, just because I *** the students in the mix, so I changed basically almost everything that I had planned on doing. So…I guess I'll just say the summer meetings were good. They were good for me. I don't know how good they were for returning fellows that have already done things. I don't know if there was anything new for them that came up, but that's my comment.

You were here over the summer right? What did you get out of it?

I was actually in another GK-12 program, and I liked the way we did this much better. The other program we did, we basically tried to cram everything into one week. We did camping trips, and stuff like that. It was a long week. It kinda got really old. We got sick of each other by the end. The whole summer, and I think it was good for me to get to know some of the other fellows and stuff so I think it was definitely good and it kept GK-12 in my mind all summer, too. Where otherwise, I probably would have gotten focused on what I was doing, and kinda forget about it till August. I did like it.

And let's see, ___, , were you here over the summer?

I was here for the meetings. I agree whole heartedly with everyone. It was nice to have the meetings. I would have liked to done a little more…but a lot of the time, we may have done explaining what some other people have done, or what some RET's had done.

Take a little segue just for a second here and ask about that relationship with the other GK-12 fellows. One of the things that came up in the April meeting was that you didn't feel you had enough consistent time where you met together to really make use of each other in terms of helping you out in your placements

and doing this whole thing. Is that accurate? Is that what I heard you say in April? Folks that were in that April meeting? Did the summer support that and if it did or if it didn't, can you just kinda add to that a little bit?

It made me feel more comfortable asking everybody else to

We developed…You got that Yahoo group going. We have started interactions.

_____ helped me out, and I helped _____out. Small, small potatoes to begin with, but yeah definitely.

We set up a meeting for this month, and we'll see.

Just you guys, right? Fellows only?

I want to come back to those Wednesday meetings. Is there anything more to say about just about summer in general? The formalized meetings were less than optimal in terms of the use of time and the content. Is that something that people agree on, because Edwin said that, like…and Edwin says stuff, but that doesn't mean necessarily make it so. Is that true, is that not true.

Meetings are…I've never really seen an efficient meeting before in my life. They weren't disastrous or anything like that. But, yeah the presentations were a little redundant. A lot of the time, a meeting is what you make of it, so just there's somebody that forces you to get together, and you use that time…I don't think we always used that time to our advantage.

Okay. I'm not talking about those Wednesday meetings, yet. I'm talking about the formal, the kick off meeting.

I don't' feel like I gained anything from it.

I can speak a little bit. I came up for a bunch of those meetings. There was like a two day meeting, which I felt like you know it was two days here and I definitely felt that could have been condensed and instead of all these presentations and what have you.

I thought I felt the second part…where we actually met with the teachers and trying to figure out what we were going to do...I thought that was helpful.

What about the first part?

The first part…so so.

I mean I think that, when obviously the teachers have to give their research presentations to somebody, and we're the target…I mean, we're the people who can get forced to go. They can't give it to an empty room. I don't think I got anything out of it.

Did you learn anything about the teachers? Maybe you got nothing out of the content.

I was just…I mean I think, whether it's justified or not, you probably make judgments based about somebody based on the quality of their work. Whether they give a good coherent presentation. But then again, it really makes no difference if you're not working with that person. It gives you another chance to learn more about them, for what that's worth.

Well, and it was after that that you were asked to submit who it was that you would like to work with, wasn't it?

No, before that. We had our assignments before that.

You already had your assignments?

Do you want to jump to that topic, because that's one of our topics? That's fine. Let's jump to the assignments, the whole assignments issue.

This year, where we only had 5 RET's, those were the only five teachers we got to know…the 5 teachers that we knew were going to be involved. Where there are 12 of us. So you know there were other people. I don't' know that the program and administration is has even requested this of teachers that demanded it in the past, but it seems like at some point, earlier in the summer, we need to know what teachers are going to be involved. Even before you know who they're going to be paired with. What schools and what teachers. I think the teachers need to make some sort of commitment that they want to be involved. I mean, it seems like every teacher that's ever been an RET or ever been paired with a fellow is sort of in the pool and is possibly going to be involved.

But that's like 30 people, right?

Which is like, yeah, 30 people.

I mean I'm probably working with 8 teachers. Two of them have been RET's. I can sort of tell it's really the school that's important. We're basically assigned to a school or school district.

Yeah I was gonna say, I mean, we aren't teaching the teachers. It's nice that we can work with them, that we'd be able to interact, but.

But, for planning purposes it's helpful to know if you're going to be in earth science or biology.

A lot of these teachers are dynamic anyways. One of the teachers I worked with was busy getting married…but that's social. She can get married any old time. Umm…but she was at two four week sessions…educational sessions or teacher development sessions…during the summer. So it's hard to plan anyway.

When they ask for your preferences…preferences amongst who…what group? Who am I choosing to work with?

I actually thought that them asking our opinions…it seemed…patronizing. I assumed they would ignore it. It seemed they were unable to make these decisions apparently. Apparently these decisions are a big deal. It takes them a long time to make them. It's not just pulling names out of a hat, so they must have a lot of

important considerations that they put into it. And therefore when they ask for our opinions two days…a week…before the decision is made I have trouble believing that it actually has any impact at all.

I got my first choice.

You're first choice was where you were last year.

It's true.

I mean, I am where I was last year. What does that mean?

I don't know, but I'm not going to look a gift horse in the mouth.

Unless you came right out and said, "I think this person is a scum bag", then they'd probably make sure you weren't there with them, but otherwise…

I got the impression, that they did consider our list. There were some statements that were made to me that they were considered and be part of their decisions. And I don't think there is…I think it's more of like a lottery system. So, I don't think it's a lot of complicated thought into….*** I could be wrong, but.

What about some of you folks that are kind of newer to this process? What did you think of the whole placement process?

I really didn't have any say at all. I didn't fill out a preference sheet that these guys are speaking about. I kind of just got an email towards the end of August saying this is the teacher you're working with.

Where you going?

You got a sweet place.

I am working with _____ and met up with him a few times. I guess when we had that two day summer conference when everyone was suppose to be here, he hadn't been at the school all summer, and they sent all the emails to his school address, and he just never checked his school email all summer so he didn't even know about the meeting.

That's why I ask you every time, can you give me contact information for the teachers, because sometimes the contact information of everyone is wrong.

The day we were supposed to meet, he wasn't here. And that was not his fault, he just didn't know about it. So…that kind of made it difficult when we had a good day to discuss plans and stuff like that.

See that's an example. If he knew he was going to be part of the program, it would be incumbent on him to check his email and know where he was supposed to be. He probably didn't know if he was going to get a fellow. I talked to some teachers in Bangor recently that really didn't know he wasn't going to get a fellow.

Was he upset?

Yeah. He had the impression that he stamped to my forehead.

I mean, I don't think he knew he was going to get a fellow. He was prepared for it, like, you know, he was planning his class having me in roughly once a week or so. He was prepared for it. He just didn't know about any of the summer activities. Me being new, it kind of made it difficult because I didn't know what to expect going on, and not even being able to talk to him made it kinda difficult. But, now that we're into it and I've met with him a few times, it cleared up pretty quickly. It's all good.

Okay. What else? What other experiences with this whole placement? Paring, matching?

I'm curious to hear how strictly people interpret their pairings or matches. You were saying that it would be nice to know if you're doing earth science, or physical science, which I assumes means…biology. So I interpret that to mean you were given a name of a teacher and said you were going to work with that teacher which seemed like a strict interpretation and I've done the opposite. I've been told I'm gong to _____ and working with _____, but I might see Joann twice this year, so I'm just curious…

So how many of you are just going and "ad hocking" it? One, two…who else is just going and just like, "okay, I'm assigned to this person but I'm going to just go wherever it works?" Three...four…oh boy. Okay. This could radically…I got make a little star here.

I was under the impression we were supposed to do that.

Okay, so what…This is why we have this conversation. The program staff may not know that…some of you are going and strictly working with a particular person that you're assigned to…and others are going and sort of negotiating how you're going to work in the school. Sound like…and that's…there's a big difference. That's really important. I'm not saying it's bad or good. But, I think that's a piece of information that they're not really aware of.

I've made it clear at least, for my part, in the journals…

You make the faces, and I don't believe they read the journals. Umm…and one of the comments I've made is of feedback indicating that our stuff has been read would be nice. And I've made that comment last year, and by golly, I've gotten some feedback. Joe normally sends me a little note now. I don't know if he does it for the rest of you.

Yeah, Joe reads things.

But, he sends me a note that lets me know that he read it. He generally says something, that's in the journal itself. So, I do have confidence that Joe reads them.

I think it depends a lot on the school system itself. Like sure, the fellows in Bangor obviously can't just go into the same classroom everyday and they have to go beyond the RET's that they work with, or teachers, but, like I go down to _____, and I go down all down all day. I can't just work with my RET every single time. I try to hit a bunch of teachers and try to make the most of my trips down. So, I work with most of the science teachers.

And you do other stuff, too, sometimes, besides, don't you? You were working with a history class last year, weren't you? Or am I mixing you up? Who was working with the history class?

I did some with social studies at the _____ grade level.

Oh, it was you.

But, I think a lot of it depends on…like what I've heard from _____, s/he and his teacher are working very closely together it seems like everyday. The teacher I was assigned to, he's…somewhat dependent on the subject, too, is curriculum, so there's less room for me there. So, rather than just when I can't be in his class, my options are either find another class or do nothing. And so…I'm trying to…my first other step is other earth sciences classes and trying to take some of the stuff I do in _____ class and do in the other classroom, since it's…it requires less…you get more bang for the buck…less prep time. You prep one module and take it into three or four classrooms, so I mean…you got a couple a years ago, I had an eighth grade teacher I worked with where every Friday like clockwork the day was mine to do with what I wanted. And so…if you got that commitment from one teacher then you don't have the time to do much else, but…you know. If you're not going to be one place, you got to be someplace else. You got to….and the impression that I've gotten, we're suppose to make more of these kinda command decisions about how best to carry out the main goal…which is what I understand, promoting science technology engineering mathematics.

I concur with that last statement that _____ made. I felt that Joe had stressed that we were make decisions to expand the program. At _____ where I'm working with block classes, it's hard for the teachers to take the whole 80 min. and give it to me. So, I've made contact with the JROTC leader there. I'm going to be going into his class once a week, or once a visit when I'm in _____ and not in the other school.

To the whole Warfare angle [for the JROTC instructor]?

Yeah…homeland security. We don't' want to make it offensive. It's all defensive, right? But, yeah, there's a lot of technology involved in the military. It's a very high-tech. It's not just that propaganda so to speak. We're a high tech military.

Yeah I think it's in our…I don't remember the exciting that Joe worked into our little workbook there. I didn't bring it with me, but, "amorphous" was definitely in there by definition. "We are to make amorphous decisions based on insufficient information....no…haha….or something that made concrete the fact that we can be vague

What are you going to be doing?

For me, more the same. In the middle school, the kids already knew me. I don't know how. But, I guess word filtered down. They were actually excited to see me. So, the introductory session at the middle school went really well. And my first session was today. That's definitely going to be more of the same.

You're in _____, right?

_____, right. And at _____, I'll be working with chemistry and physics and conceptual science which is kind of the…we call it funny book science, for lack of a better term. So, we're going to be weeding out the things that didn't work last year, enhancing the things that did work last year and throw in some new stuff. And working with the JROTC and possibly music classes.

Are you split between the two schools, or are you primarily at the high school?

Primarily at the middle…well, I split, but I'm actually working more intensely with the middle school, because I see the same students every time I'm there. So I go twice a week and see the same kids. But because of block scheduling I see different kids for the week at _____ school. And I'm divided between two teachers there.

Okay, so for example, you're the only person I gave one middle school survey and one high school survey to. So, I figured that would be most appropriate for you. K. What else, who else? Tell me about what you're doing.

Just a general question. I mean, on the average that have been doing this for a while. How many classes do you see in a given week? I know they're saying we should spend about ten hours, but I know where I am, with _____, he has two classes. You know he has two sections of freshman science where it's split up where scientific method and then goes earth to some, then astronomy and then chemistry then physics and they just touch a little bit on all of them. And _____ is the other teacher there and she has five sections of the same science class. And I think…some people know _____, or have heard of her. She used to be in the program, I guess, is what I hear. So I've spoken with her and I got to meet with some of her classes as well, but primarily I'm going to essentially see, both of _____ class once a week, so I'll be in those two, and then five _____ class, just kinda hitting them up sporadically. But, on average week, how many classes do you usually get into?

six to eight.

Me, similar. Two days…basically two full days, and I try and pack the days as much as I can. So, if I have a teacher that only has two classes that I can visit, I'll try to find another teacher that has two classes you know, that offsets those, and maybe a bunch of teachers. So, teacher A gets three visits and teacher B gets three visits, and those are all the filler visits. But, I think you have time to get your feet under you. In other words, I wouldn't stress making sure you fill your ten hours or your eight classes, whatever it is, until you're doing the classes you are doing comfortably and well. Obviously I'm not paying you. But, that's my feeling on it.

Another thing is, is that at _____, they have an hour and twenty minute classes. They have block scheduling, which also makes it difficult so you can essentially see less classes.

Well, maybe you have classes sometimes, if you only have sixty minutes to say. I don't know…

I can't imagine being up there for 120 min straight.

Well, _____ has 80 min classes as well, and so far it's been… I've just been taking a portion of the classes and then whatever I do, then I just still hang around and help _____ out with the rest of the stuff

he does, generally if it's just there to answer questions. You know, I make myself useful to what he's giving the rest of the class. But, I'm not actively teaching. I'll just help out whenever…

That's invaluable. Just hanging out.

That's what I've done so far. I've gone to _____ classes. I've essentially said "hi" to the students, but then I just sat there while he ran is class and observed and helped him handing out papers and collecting them, and talking to the kids. But, that's the point I'm at now. I'm actually not doing my first full lesson until Sept. 25th. So, and he said when I do come in, I have the full hour and twenty minutes. So, I just have to figure out how I'm going to fill it, or if I'm going to talk to him and take half of it, or what we're going to do.

You'll be surprised at how fast it goes, if you have kids doing an experiment.

Or how slow it goes.

How fast the hour and twenty minutes goes.

What was your question again? What have we been doing?

Yeah. Okay, this is good. But, you see what happens. People start talking about "oh, you've been doing". And other will have questions "Ah well I've been doing this, is that what I'm suppose to be doing?" Which I'm hoping is good in this forum, beyond just some evaluation and baseline data gathering for me about what people are doing. But, you're getting something out of this, I'm hoping.

Well, hopefully on the 29th, we'll have a good chance to chat about some of that stuff, too. I've been basically…restarted my physical science program which I did last year, and that's just…I just started this week…that basically started right off.

So, you've been teaching?

Yeah. Yeah I taught Monday.

Anyone else?

I've been doing a lot of meetings. Meet teachers as we feel out where the *** come in play. Mostly the middle school so far. Meet with the eight grade teachers today. I met with gifted and talented teacher. Just sort of figuring out. Social Studies invited me. Eight grade science and math. They're all excited. They had ideas…stuff I can do. So, now it's going to be basically scheduling

Where you at again?

_____

That's right, in _____. There's a lot of hands, but I'm not hearing a lot of people jumping up.

I'm in a similar type situation, where I'm finding it difficult to make sure I have those *** hours there right now. Just because of the set up of the school and scheduling issues. I don't know if it's relevant to our

conversation now, but part of the problem's that the administration of the school didn't know I was coming in. And the teachers been dealing with some funky stuff there.

Yeah

you want to share? You don't' have to. I can't make you do anything. But, I sure would appreciate it.

I'd love to share. Friday I did my intro to eighth grade physical sciences. It was four hours straight, not with a break, and then another period after that. So, yeah I was a little hoarse, but I'm not going to speaking the whole time. It was just an intro. I talk most of the time, too. And I was used to that from last year where I'd just go straight for a couple of hours. And Monday I did some more intros. the biggest thing was to introduce _____ to them, and who I was, and what I do. So, I talked about that, and they had a lot of questions. Today we went on a field trip, and we were mapping the GPS…a species of the basic crabs…green crabs, that have kinda taken over ***. It's been a very long day. I've been out in the sun all day. So, let's see. It's up in Searsport. It was a great time, and we got some good data. We find anything but these green crabs, which is not good. So, it should be a lot of fun to go through them and this is one of the teacher's ideas and I just kinda helped out.

Who else has been teaching?

Monday, I did my intro to the program. I went in and *** last week. Monday I did my intro to sensors in _____ class. Friday I'm going to be in _____ another physical science teacher…same day. So far…

And it's purposeful that I'm trying to talk to you right now. Cause we're just starting. Get a sense of whether the new fellows are starting to teach right away…whether they weren't. you've been a fellow before? It was kinda old hat. And you had two Don, right?

Yeah.

Have you been teaching yet?

No I haven't . both my teachers asked that I didn't come in til a little later until everybody gets settled in. Worked out really good for me. Cause I just took my PhD qualifying exam. Just as happy that it worked out that way.

You can tell by your sunburn that you passed.

I don't know yet.

Who else has taught? We missed anybody?

Thursday was the first day for me. I did a little introduction of myself. Plus I introduced some of the things I wanted to do for this year. It was interesting because some of the teachers came by and actually sat through my presentation and then invited me to their classes later on in the day, which was cool. So I actually ended up taking part in more classes than I had originally planned. Yesterday was my second time

there for another class. So that went well. Students seemed to be excited about that, and what I'm doing. One of my teachers I'll be interacting with _____head of the math department, so I guess when you have an authority figure like that who has…you know he did a lot of stuff…you know in terms of resources and I have access to a lot of stuff that I might not have had if I wasn't working with him, cause now Bangor High School math department has laptops…five or six laptops that I can take into the classrooms for some of the things that I'm doing. It helped me out a lot gaining access to those laptops and he's also helped me out in a lot of other things…getting funding for some other stuff that I want to do later on in the year.

So, it sounds like you've got a pretty broad range of things that you've already got in mind to do.

Yeah. I guess I have ideas, but I wish I spent the summer preparing out the details cause now I'm spending a lot of time working on these lessons. Which I guess would be mostly my own fault.

I'd like to add that I feel that, I guess it must have been the GK-12 program was at _____, and they definitely left a warm feeling. There's a lot of confusion, like the principal introduced me at the staff meeting two weeks ago and he's like Edwin Ngay, and he's like "he's not an NSF fellow, but it's a similar program", and I was like, "No, I am an NSF fellow in a different program". His only memory that I was going to be in the school was that he had pizza with Vet at Pat's pizza and there was something about sensors. Like, as soon as I said the word sensors, he's said, "oh yeah I had pizza with what's his name?" And other than that, eh was quite surprised that I was in the building, but I guess contrary to your experience, he was half at it, and he was all excited, and part of that may have been that there had been a GK-12 program there before.

And schools that have had a history of it…and I don't know what's going on with _____, but, that's a whole separate question for a different conversation.

They don't even want me to go in at all. Period. Right now. I don't know what's going on. So…it's like I'm cursed. There's some issue with the superintendent.

That actually does remind me though. One of the issues that came up was the question of fingerprinting to work in the school. I had already been fingerprinted for a previous teaching job, but I don't know if that's something that's come up in the past and that we need to be aware of.

It came up in the past, and the thing is that we're never left alone in the classes, so we're treated like volunteers, and I don't think volunteers are fingerprinted.

It actually depends on the system. But, I was talking to Joe, and I discussed that you know, of course the people of _____ know me, so it really wasn't an issue once they knew what was going on. But, at any rate, they were asking basically. They got a new vice principal who didn't know what was going on, and when he was talking with _____, my teacher, he was wondering if they should get my fingerprinted, and so I went and said, "you know no big deal, I don't' have any skeletons in my closet, so I have no problem doing it". When I talked to Joe he said if they make you do it, you can get reimbursed for it. Cause obviously you do it, and its fifty bucks.

There's a couple of things that I'm hearing and tell me if this is wrong. But this is what I'd take out of all of what you just said, and that is that the permissions and communications between the program and the administration of the respective schools in which you work, has not been sufficient to insure that everything is set up for you to walk in on day one and begin work. Is that correct?

If there's a problem, we're supposed to solve it.

And do you even have the authority to solve such a problem? My guess is that you don't.

That depends on the level.

Yeah, the teachers are great with it, that's fine. You get to the administration level, with my experience, there's no flexibility.

Right, well they have to have a policy for it. And without a policy, it's not going to happen

I want to disagree with that statement, cause I went in met both the principal and vice principal of _____ no problem. They were glad to have me. We started right off with the teachers.

Were they aware of you ahead of time?

I have no idea. I never asked.

Because _____ has a long, long history with this program…see that's the difference. What I'm saying is for a principal that doesn't know the program, never met you before, doesn't' know anything about it, they're like "I don't know."

Honestly I've heard that there are politics involved, too. Because they worked with the other program, loved it. The teachers were very welcoming. The principal is kinda doing the "I don't know about all this new program, so I can't say…"

And my guess is that it will all get resolved, but what I'm taking from what all of you are saying, that this was not worked out in advance of you starting this fall, and perhaps should have been. See, that's what the bullet point will say in the evaluation

And I want to say that, I can't use this year as a baseline, but last year entering _____, the teachers both let the administration know in advance, so if there weren't policies, by the time I got there, they were set up and things went smoothly in both schools, and of course this year is just a continuation.

But, in your case, nobody knew?

Right, until a couple weeks before school started.

Things have changed in schools, too, a lot, even over just the last two, three, or four years, in terms of wanting to control who's coming in and out. Okay, well, we're getting close here. Okay. How much time

are you spending right now on GK-12? Average, per week. Total, everything. I know I asked you this in your survey, but I kind of wanted to let you get a chance to see what you're thinking.

I'm only a week and a half into it. This week, I'm going to be in class about twelve hours and last week, I was in class maybe five, so…I mean, hopefully I'll be in more this week than last week, but last week I just came in, introduced myself. I didn't even take the whole period…just "this is me, this is the program, this is why I'm here, what we're going to do".

That may be the case for a lot of you at this point. But this is a stat I'm going to ask for a few times during the year. Just a few key things that I want to check in. Not the whole survey but just a few key data points, like " how many hours a week are you spending on this, how many on that, how many on the other thing" and just to kind of see, does this stay constant over the years, really fluctuating? Is it highly variable between fellows...or not, depending on what you're doing.

One thing I'm seeing that may be helpful into getting the second week that I've been in, I'm hitting the 15 hours but I'm not in classroom for the full 10 hours yet, so I'm a little concerned that once I am in the classroom 10 hours, that's going to go way over. If that's a guideline of just the reality of being a grad student and having other responsibilities, I think that's important to know for the evaluation.

From my understanding the 10 hours is just a suggestion.

I spent about 10 to 12 in the classroom, depending on the days, but realized that I only usually have 1 prep for those.

It is an arbitrary number, but it's not an arbitrary number if it comes from Vet. I mean, it does…uh…the way that came up…the context where that came up for me was talking to Joe about my conversation with _____ and how that went. And how there had been some conflict with him and the administration because in the last couple years his fellows worked substantially more than 15 hours a week, maybe more like 20 or 30, and how the fellows had to be in power to be able to draw lines and say this is too much…it got to the point where research lying or something else was falling, so it does…it's a number that comes from inside the program. The way I've always interpreted things is do the best I can and do what's appropriate for a given week or a given class. But, I've never been able to do anything that took ten hours in a class that only required five hours to prepare. It's more like it took 30 hours to prepare, and maybe that's a flaw of mine though.

I think it's important to remember that we're being paid to do our research also. There are two objectives to this program and one of them is for us to get graduate degrees, and that's right in the proposal and we're not going to degrees if we don't' do our research. And it's like with other fellowships, you're generally not allowed to work more than 20 hours a week. If you're a TA it's 20 hours a week with teaching, if you're an RA it's 20 hours a week with research. Because we are first and foremost students and so I think that's…I think if there's a guilt issue about not spending enough time in school…in the schools…just remembers that half your job is graduating.

Yeah if you don't graduate, it's really frowned on.

Well, we have till 2011, so…

Alright, I want to turn the corner here, and this is the last segment and this is really where we get down to brass tacks. Tell me about the administration of this program. Tell me about how the program managers done since we've last talked, for those of you that were in the last conversation. Let's start with Joe.

I felt like he's making a considerate effort to meet our whines and things. And I respect the effort and I feel that personally that most of any of the short comings are things that are not his…that he is not necessarily in power to deal with. Like stuff like some of the communication issues, the placement timing, the meeting…well, I was even thinking of the content of the meetings. A lot of that kind of stuff, although I'm sure he has input into them, it's not his say. But, I feel like, in terms of being the liaison between us and the PI's and sort of doing his thing, he's definitely been pushing himself pretty hard.

Yeah I think that introducing that handbook was a big step towards at least explicitly stating what amorphous or undefined, but he did it; he put it together and told us that it was a document in process. I mean, it looked like it was quite a bit of work.

Joe's a vehicle. If you don't like what you hear from Joe, it really has very little to do with Joe. I mean, he just seems to do the best he can and works hard, always has time to talk.

He makes the time to talk, whether he has it or not.

Or takes the time to talk. If you usually go into to ask Joe a question, you usually get whatever thoughts he's been thinking about the program, for however long it's been since the last time you talked to him.

One of the criticisms that came up in the April meeting was that requests were not made in any timely manner. The quote I think was "really good on the response but almost nothing on the preparation" or something like that. Has that changed?

I think so. Yeah.

If anything else, he's apologetic at making last minute requests.

It seems that this summer, we didn't get many last minute requests. The placement was late, but we knew the schedule for that August meeting in June.

It was a minor miracle, at least something you'd never seen in the last couple of years.

So, you see a difference?

Yes

Alright, let me turn the corner, here. What about the PI's…the PI, the PI's, the co PI's?

Still invisible

No sense of change.

I don't know what's come up in the past, but talking about Joe and the PI's…the only difference I've really seen the PI presence is in Joe's emails saying "Let's try to set up this meeting. If you tell me you can't make it, but we still need to schedule it for that time, too bad, you need to make it." And that just pissed me off. I understand this is a very important responsibility. But, to pretend like you're asking…and I understand you can't accommodate everyone, but someone else also needs to understand that if two weeks in advance I still say, "I'm very sorry, I still can't rearrange", I would love to see some respect for that. And I don't think that came from Joe.

Right.

On a similar thing, I definitely felt during the two day meeting and the kick off meeting, that we were waiting for Vet to come back from jogging so that we could continue our business. So, just uh…lack of respect for our time maybe, in some sense.

But, should you? Or would it be really nice to have a program where everyone respects each other. I can understand hierarchies, but there should still be a level of respect.

I guess maybe my problem is that I've just given up or tune down…knowing and just getting used to it and accept that for ten years and he's not going to change. I don't care what we say in this meeting. I don't care what Brian tells him or what Joe tells him. Vet is Vet and has been Vet and is going to be Vet. So, I don't like when it rains either, but I don't say ____ you just take cover, and I'm not saying its right, but yeah, eventually you carry your umbrella around.

I don't believe it. I think if we all quit because of this, then things might change.

I don't think you will, but…

And maybe it's not likely to change, but I don't think it's unchangeable…I don't think we're going to change it.

When I say unchanging…I mean…in conversations with Joe, he assures me that Vet does listen…when we filter things through…he does appear to listen. And the program has changed. This year the prep and the communication is better than it has been, that expectations are more clear than they have been, so I guess things have changed somewhat. As far as from 11:00 to 1:00 Vet is going running and that is not going to change. He's done that every single day I've ever known him from 11:00 to 1:00 he was over at the gym.

But, the criticism is valid.

Exactly.

I do have something positive to say. I submitted a proposal for a fieldtrip, and I was very impressed with the turnover time. It was a week or something. It ran very smoothly.

And that was through Vet?

It was to Vet, via Joe.

Well, yeah, maybe, but he's still got to say "okay".

Did you in general see a positive change in the administration of the program? Overall? Not so much?

I don't know. I don't think so. I think as far as stuff like scheduling. I think most of that has fallen on the other shoulders personally, but I don't think much of that is Vet.

Right, but I'm not asking specifically about Vet or the PI's. Remember he's not the only PI.

Speaking of invisible.

you haven't even mentioned that Connie and Steve are attached to this…

Well, we don't even know if Steve is a PI or not.

Okay, well, that's consistent with April. So, that's unchanged.

In all seriousness, who's Steve?

He works at Bangor High.

There's two other co-PI's besides Vet and Joe. One is Connie. She's over in that building, and Steve's the head of the math department in Bangor.

But, in no formal way have they presented themselves to the group as being PI's?

That's not true.

I specifically remember Connie.

Connie headed up the first weekly meeting we had, didn't she?

Yeah.

Granted I'm new.

When Joe handed out that handbook, I remember, because there was some sort of typo. Steve was extremely concerned because he wasn't mentioned as a PI.

He was sitting right there.

Yeah he thought he was a PI, and folks said he wasn't, so…

Right.

But at the kick off meeting, Steve was there it seemed like, in his role as math teacher at Bangor. He spoke with all the other PI's when we were reading our plan. But I don't think he introduced himself.

At the initial meeting at the beginning of the summer?

No, at the one up here…

At the end of the summer?

Yeah.

Have you gotten a letter or an email or contact that says, "Geez, how is your placement going? What's happening?
That's answers a little bit of my question. I was going to say, I don't know exactly what I should expect from the PI's in the program other than…basic administration, but otherwise, I don't know what I'm not getting that I should be expecting or…

I don't know either.

But we're getting it from you, and you're because of the PI. So, in a sense, someone's asking us how the semester is going.

Well, I am, yeah, and that's true. And I am, and I'll report that back and try to do it in an unfiltered, unbiased, and non-identifiable way.

So, I do feel like we're being asked how things are going.

Sure. But he doesn't know what I'm asking you. He doesn't ask me what I'm going to ask you. I determine the content of the meetings.

But, you are evaluating how stuff is going, and presumably that's going to get back to him.

Yup, I'll be sitting in this room presenting these results back to him in a month…a month and a half or so.

One thing I want to remain to be seen that I just…in my last journal article, highlighted that I specifically asked Joe to specifically ask the PI's to get back to me about…and that is that in the original program abstract form for track one, it said that faculty members representing the major departments at the university will be involved. Just the way we were chosen by how special we are. But, to my knowledge, we don't' have those sort of connections, and that's something that just recently I came up against and everyone was able to help me, making contact with somebody outside the program surveying engineering technology program to get some of their equipment to bring in. But as far as I know, we have no formal connections and no way of establishing other than just through our own… And the teachers in the schools…we kind of represent the university and they sort of expect that we have the full power and capability of the university behind us, where we may only have the power and capability of the lab we work in behind us, or what we can…or what else we can establish. I was extremely happy…I didn't know they were going to let me take…I don't know how much this piece of equipment costs. I wasn't really certain they were going to just…and I really don't think if I had stopped by on my own, I don't know that they would have let me. I don't think they understood I was going to let someone else touch. Maybe I won't if I find out how much it cost. Talking about sensors, there's a lot of stuff that goes on that I'm not aware of, that would

be useful. And I don't know if we have any…I think you'd get a lot better reaction if Vet called across the street to somebody and said, "You know I got this program and these students doing this".

You may be making a bad assumption on that sort of case.

I think there is technically a list of like 30 or so faculty members who are associated in the program. They should know they are on the list. I don't think they can be put on the list unless they're told, or asked.

See, that would be extremely valuable list to distribute.

Yeah, that would be useful.

And that was back five or six years ago, so who knows if they even remember.

So, I guess one of my comments on how well the PI's are doing their job…wait until I get my answer for that, because that's something that's going to be really important to me. And it's something that seems to be right square in the middle of what they should be accomplishing for it, other than just things like feedback on journals or…

But, this is an interesting question. This whole faculty contact piece. So, what I want to do is take that point, you know, but maybe you don't all agree. Is that something you all are all given contacts and networking to resources to the university through this position? How many of you would say "yes"? How many of you would say "no"? A bunch of people didn't say anything. So, how many of you would say "yes"? And I just want to get a sense, is that how the group feels? Everyone else says "no" right? But you haven't explicitly gotten those contacts or purposefully been introduced to faculty from different departments to gain access to knowledge or equipment or people or whatever?

I'm sorry, I'm getting lost. Can you repeat the question?

Has the program staff, whether it's Joe, or Vet, or whoever, set up some sort of a structure through which you can get contacts into other departments with other faculty, labs, or whatever, to gain access to information, or equipment, or people?

No, but I can see it as a valuable tool. I'm not convinced that it is really that important.

Not that important to you?

But important to you?

Extremely important to me.

Okay. How many of you would say maybe this is in a future survey question, but maybe I can capture it right now. How many of you would say that it's quite important, or quite or very important to you, to have those contacts and to be able to get access to them?

Somewhat important?

Not all that important?

All right, so I'll bring this forward, but it's not as important to everyone as it is to a few.

I think that if we have a network….I mean, I would say that between however many of us there are, we all know somebody who knows somebody in every department. So as long as we can talk to each other, we should be able to get everybody hooked up.

I see it as another one of our amorphous undefined tasks.

It would be nice to be introduced to the principals at the schools, or the superintendents, or the teachers, too. That might have been a nice…or come to our meeting. That would be have nice, but I feel it has been left up to us to make those things, so that hat the PI's have decided, whether it because they think it's the best decision or because, that…that's our job.

If it wasn't expressly stated in the abstract, then none of that would make a difference to me, but it was expressly stated, but that was an aspect of the program is that the university is involved, not just to professors and a high school math teacher.

They don't give that kind of money to two professors and a math teacher…seriously, in order to give out this kind of money, requires it to be a big project.

It's a lot of money. There's no doubt about it.

Honestly I think it's more efficient though if we network amongst ourselves and how many departments are presented here. Look someone up and see what they have to offer.

Would there be benefit? Let me ask this question, because I'm going to redirect what _____ said and kind of turn it around to more of a problematic component. Would there be benefit, perhaps, in having this presented because you may not even be aware of all the opportunities or resources that exist?

Yes

Yeah, I think if that list of 30 faculty members is real and if they're aware of the program and they've already offered to help, I think it would be great if we knew about it.

That the value about it. When you started to say that, I was thinking "Okay fine, you want such and such" but to me the real value in a structure like that is presenting you with opportunities that you know are there. Not that you're not all smart people, but you can't know everything.

Yeah I didn't obviously read the proposal very carefully, but I had never heard that this list existed.

I had never heard of the list either.

Somehow I got my hands on a copy of the list. The very initial one.

Yeah I got the initial one, too.

What else is it that people want to talk about or share (I hate that word)…talk about, or express, that we haven't covered or we haven't hit on? Because this is the opportunity to voice something that will go directly back to them…and I have them as a captive audience.

One issue I have is always probably going to be an issue, because I don't think they are going to do anything about it. But, in my situation, this is the second time I've had an issue going into the school. There is no back up plan, you know? It's at a point, where in this situation, I can't necessarily solve and there's nothing I can do about it.

But then it's going to come back on you is what you're saying? If too much time goes by, even if there's nothing you can do about it, you brought the problem forward, but if it's unresolved, it's going to come back on your shoulders?

And it did last year.

Has anyone else, has that been the case for them? There's been a problem, and it couldn't get resolved over a period of time and they wound up getting the responsibility? Maybe I should be that forthright in asking such a question, but it's on the table.

My situation may be unique, too.

There's no backup plan? That would be true for any of you, if you had to leave your school tomorrow for whatever reason, if things don't work out?

On a positive note, and it's purely anecdotal, but I went in to _____ today for the first time and saw a slew of the 8th graders that I worked with last year, and I couldn't believe the positive response. They're going out of their way and saying "hi" to me. Whether they're going into science or not, I don't know, but apparently I've had some sort of impact. The same with the students that I've had in high school that I've got again this year in a different class, they've been very positive interactions, so…

That's great.

Yeah I'm actually getting it because of other GK-12 people. The students say, "Well you must be awesome because that other person in our class was awesome."

So, I think that the program is having an impact, whether it's the intended impact or not, I don't know.

And I don't really know what it is. Because actually it seems like…all the fellows seem to get positive responses from the kids, and I don't really know what exactly I did, but the kids, they walk by and see me and the same classroom I was in last year, stopped and poked their heads in and interrupt. And I don't know why exactly…

Well, what we do is cool. To them it's something different, it's not stuff they normally see. To us it's like, oh this is pretty basic stuff. For them I think it's cool, it's different, and it's stuff that they wouldn't have seen otherwise.

And you're not their everyday teacher.

I think a lot if it is also they get to show off to their friends that they know a stranger walking down the hall.

It could be. I'll take it.

It doesn't really matter why…you know.

It could be something as simple as, what you said, you're not a teacher. They see teachers all day everyday, all year long. Someone who is not a teacher is actually coming in and spending time with us, is sometimes all it takes for student.

Yeah especially if you seem like you like being in there, then that's even more. There is a person that wants to be here. They don't have to be here.

What else, anything? No? Alright well, we will do this again in the spring.

GK-12 Fellow Focus Group May, 2007 Edited Transcript:

What I wanted to do is because it's almost impossible to complete a narrative on a survey and also because the interaction is good, bring people together to talk about how things have gone this year, how your placements have gone, what's gone well, what have been sources of frustration, what are things that can be done to improve the placements; and then secondarily, the program itself, communication, interaction with the PI, with Joe and with any of the other folks; and then third, the impact of the program on your own course of study, where you're at, whether you're making good progress, how is this facilitated how is it detracting from your progress, if it has.
How are your placements going?

Mine's going well, I'm really happy with it.

How is it going well, what in particular is making it go well?

A few things, I had never worked with middle school students before, and I really am enjoying that a lot, a lot more than my previous work with high school students. Also working with my teacher has been great, she's very flexible, and she's also very honest, I feel like our communication is good, so if there are weeks when she says "I'm sorry I just need to do this for a class" rather than have me bring in something else, I like that she's upfront about it and I feel very happy to just help out and she seems to be very appreciative of me helping with things that aren't directly sensor related or what I'm bringing into the class.

What else, other folks?

It's going very well, I work well with the teachers I have, there's been one kind of issue with one teacher, she's very inflexible in the sense that she just wants to do the curriculum that she wants to do and doesn't feel like bringing outside stuff, she wants to tell me exactly the activity that she wants to do, but she talked to the PI and he was ok with that so I'm ok with that if he's ok with that and it's worked out ok once you get past that, it was a little rocky at first, but since then everything's worked out, other teachers have worked great. Other teachers have worked very well with, and _____ worked well with too, it's just that she wants things to pick out the activity that I'm going to do and basically I go in and teach until she wants, from my standpoint that's not what the program is about, I'm not taking anything new in, and it's often stuff that I'm not an expert in, I don't know more than she does. But I talked to him about it and he was ok with it, so go along with it.

Good, you said you communicate well we get along well, but what it is that's making it go well and how does that work?

I find that teachers are conscientious and I can usually learn quite a bit from them and they are willing to give feedback and from my standpoint that's very helpful, in the past I've had some teachers where they just sit back at their desk all the time, didn't really pay attention and I did my thing, they said thanks and I was out the door, I don't feel like for the most part I get this and there's still some teachers who disagree but usually there's a lot more feedback at the end of class as far as…

So give me an example of the feedback that you got.

For instance, yesterday, I was working with one classroom and I made a few notifications from the morning class to the afternoon class, just things that I thought might work a little bit better, and she came over to me after the second class and said "I really liked what you did there, it's very important in teaching that you're willing to be flexible like that and change things if they don't work as the class goes on" so that was one example where I got some feedback that helped and it will count later on as I do other classes and stuff.

Great, so it's going well?

Yes.

Good.

How about you?

My placements are the same again, it's going well I get along with all my teachers, in other words, it's collaborative, it's not just they sit back, often they'll bring up ideas that I create sensors into try to fit everything into the curriculum especially at the high school level, and it's closer to my house, so it's not bad, I'm working in _____so it's actually closer than if I come up to the campus.

So it's a collaboration, and a lot of these words, so when you take your first cut at this you're like oh it's going well we communicate well, we have collaboration, we whatever, but that's really surface level, what is it that's made this work well with the teacher's that you've got?

We have fun at each other's expense, that's one teacher, we joke around.

Give me an example.

Occasionally I'll say, I'll make a comment about older people like the hair, so it's just humor like that and it's stuff that's evolved over time where he's introduced it and done the same thing with me, so, we've worked two years together so it's kind of a good feel for that.

It sounds like you've built a relationship.

Right.

At the high school it's a little bit different, more his respect type of thing, he's very capable, he's as a young teacher, he's very excited and really cares about the students and conscientious about what he does and giving me again, comments about something she thought was a little bit sketchy or I use different terminology than he uses with her class so he lets me know and we iron things out for the next group of students.

Sounds pretty comfortable.

Yup.

How about you?

Beautiful, don't have any complaints. One minor one, but the teacher and I cleared it up, it was just me coming up with multiple labs for one week and then he was going to do one of them and I was going to do one of them, that kind of irritated me because that's not my responsibility to make up labs for him to do, so we clarified it and I'm just going to do it the next time. So I kind of stood my ground and said that. Involved watching video, he's doing a global warming unit and it's just a video…

And you?

Well I work with two different classes, one is computer science and the other is pre-calc, one class of computer science, two classes of pre-calc. It's mixed up, mixed bag of reactions; the computer science class is going really well, done a lot of stuff. As far as all the teachers there, there all very, very cooperative very nice people to work with. The computer science class is going well, and what I'm trying to do, I guess this is something that I'll change in the future is what I tried to do is come up with year long things to work on and sort of break it down into small chunks and then try to get that going and try to accomplish a little bit of that so that you have rather than taking 20 different topics on actually getting a good feel for, at least that was my idea.

That was your idea for this year?

Yeah, so it worked well in the computer science class, actually I had two almost year long things going on, one is computer graphics where they actually build a game using some of the stuff that and open, and then we actually get into where we build digital circuits and we build an outer circuit and hopefully I'm going to introduce actually how to use a micro circuit and so, computer science is going great. As far as the pre-calc class is going, I think I started that year off with a bunch of unrealistic expectations, the things that I wanted to do were not things that the students were capable of doing, one of things is that I wanted to present modeling mathematical modeling using computational software where the students would choose a physical phenomenon to model and then basically we would spend the year working on it and I would tie in different topics as they covered it, for example, they did some stuff with trig, the thing is what I'm doing is completely in both of my classes are just outside of their curriculum and these are things that they wouldn't get otherwise and I felt that that was important, that that would be interesting to the students, and the computer science class that's gone very well, they really like this outside material, they find it more exciting than the stuff they have to work on. But as far as pre-calculus class goes I think, like I said I went in with unrealistic expectation and the other thing was, because this was outside curriculum and I'm only in their once a week, and I guess what I'm trying to do is more involved and it ends up, plans don't go as well as I had envisioned.

I'm willing to bet you're not alone

Actually yeah, I came into this year, expecting to do a lot of larger projects and have students teaching students, my brother in law teaches and it's a model he uses and it works very well, and I like the idea behind it, but if students had never been exposed to it, you can't just drop right in on them, and say ok, do this big project. So Sue and I have actually been talking about how to build the foundation for next year so that we can do some of these projects, that are outside of the realm of what they've done before but first we need to identify what kind of foundation we need to be able to build on it later.

_____ *you've done this before, last year?*

It took forever.

You hadn't done this before this year. I'm curious what your take on that was in terms of what you thought the students might be able to do and then what they could do but I want to come back to you and have you do the same prompt to that everyone else did in terms of how it's going but do you want to talk to about that, how they were doing compared to what you thought and work in your other answer?

As far as the student's capabilities, it's always a lot less than, just last week I presented module that went pretty badly because I expected them to be able to transition from something we had done earlier, so I said, remember that module that we did a while ago? Take that, all you've got to do is do this, didn't work, I was very frustrated. I've had to learn, that you have to tone it down a little bit, I don't know if that's exactly answering your question as far as what they're talking about but it hasn't been exactly like I thought, you just go in and fire it off, it hasn't been as easy and straightforward as I thought it would be in that area so I've had to rehash things, break it down into smaller chunks.

Do you find yourself go in and you're like well this is so simple and then you look out all of a sudden and you're like…

Oh yeah, all the time. I'm like oh good, ok you get it? No one has any idea what I'm talking about; I have to go back through it again.

Does that happen to all of you?

Occasionally. Not so much, but it used to happen to me a lot.

Yes, definitely. It's definitely gotten better as the year's gone on too, you know last week was the first time in a while I should say. Beginning of the year really took me a while to figure out exactly how I'm doing this.

Does getting to understand what the students can do change what you try to present to them?

In my mind, no, I think you know it's changed the way I present things and how I lay it out but I don't think it's changed what I do, it's changed the quantity of things that I do. But instead of trying to get everything into one class I'll do it over two classes or several.

I agree.

I wouldn't say it changes what I do but the techniques that I use or how I tend to question the students a lot more asking do you understand this and if we have a lot yes's than we might ask questions…

So explain that to me, give me an example.

I use that a lot they give me the correct answer, I will oftentimes say ok, that's the right answer, but why, and that really helps me determine if they're getting it like I think they are, so that's one thing I do a lot.

That's one of the things I was curious about as fellows became more experienced whether you would shift away from kind of your idea of what was the ideal in the classroom to bring in it's like this faults with the University would that change, but yours didn't…

Not as far as what I bring to the classroom, I mean feedback is definitely important, I rely more on that if I see drooling mouths and eyes look like head lights have been shining at them, I know that I've exceeded their capacities, and sometimes there's just days, and there's one group of students I have this year that are just, they're out there, and I know it's not me, I've seen them interact with a teacher when I'm not doing anything and it's the same so, you learn to recognize sometimes it's just a class.

They've actually either resigned themselves to just being quiet, the difference has been night and day for that group, this is a group of seniors, and of course as you know as we head towards graduation, it just degenerates from there.

So, tell us about how things have gone for you this year.

Great, I got a perfect setup that I'm very happy with. Took me a while to get situated and comfortable and I've learned quite a bit since you observed me, a lot and we both found our groove and work together, Mr. _____ and I and it's very similar to what _____ was talking about, it's like yup this is the kind of situation I've got, you know interaction with the teacher, friends, make jokes about, that helps the kids stay interested, friends with the kids too, we both are always coming up with ideas, cause he likes the program a lot cause he's always getting new ideas and my teacher, he's got five or six huge projects he lines up for the year and in between those I've got modules that I'll spread out in between more like one week, small things, and when he's got his going on I bring in new ideas like a topic to discuss to give them ideas with what they're doing on their bigger projects, so it's great, works real well together.

That's great.

I like it a lot.

What are the students getting out this, I've got three themes here, one is your experiences in the school, second one is your experiences with program staff, and the third thing was to talk about how this is impacting your own progress in your own programs, PhD programs. So before we leave the school, what is this doing for the students, what evidence or observation would you make about your impact or the impact of doing this program?

I guess I would say for me long term, I'm not sure if I'm really affecting them whether they're going to be scientist or engineers or not but I know in the short term definitely they are more motivated they enjoy the types of activities I do as opposed to sitting in class and taking notes. They get very excited while doing a lot of the activities so certainly in the short term I think it's accomplishing goals but long term I really couldn't say.

For me I don't know if and what it's doing long term but just having another adult in the classroom, I've received feedback from a few teachers that I worked with at _____, that really helps even on days where I'm more supported, one of the teachers has to do a certain lesson and they're not prepared for me to do something separate, having me in there and helping these students one on one with those who maybe need some more support I've been told that's helpful. I don't know if that's really the goal of the program though.

I don't know, I know that my kids were very open, very friendly with all my kids, I've got a good relationship with them, as far as being in between a teacher and a student kind of set up and they feel comfortable with it and I was like oh I love coming on these days because it's fun for them, and stuff so I know that there's a lot of enthusiasm a lot more than I think there was beforehand and so _____ has also said back that there is a lot more enthusiasm, and I don't know about long term I bet you I'm going to steer some kids towards it, keep the kids that are already interested in it going further cause they can come talk to me but it's also, I'm in the seventh grade level so it's very young but all I know is that short term there's a lot more enthusiasm coming in when you know we're all going to be there which I think is a great start at least.

Well I think what I've tried to do, my intent was sort of reinforce with the math class my intent to reinforce how math can be applied to explain things and present them with a view that they might not consider otherwise, for example one of things that we're doing is modeling sunrise and sunset events, so one of the things that I want them to do is actually come up with an expression and give them a scenario, so that's one of the projects that they're doing now, to describe it, so I guess to me it's clear that I want them to get out of this in terms of long term is basically see how math can be applied outside of the textbooks outside of the problems that they work on in class, I'm sure that they don't do anything like this, but just the thought of hey you know I now know how to summarize this or I know what the, I want them to be able to get a feel for that, so I think that will go a long way toward, and I guess this is what got me in trouble in the first place cause they're not capable of thinking in that realm, they're not prepared to take that step yet, in thinking terms are much more broader in content, so that's the pre-calculus class. As far the computer science class goes I think they're getting a long term benefit, I guess simply because we have a year long project, at least two year long projects for them and we work on it every time I go in there and especially with the developing your own game, it's not just fun and games, playing games might be fun but when it comes down to actually writing your own game, there's a lot of things that you need to be aware of in terms of preparing and so forth. Which I feel are skills that can be applied in many different areas and I think they are starting to grasp that. For example when you sit down and actually figure out what you're going to do and plan out what you're going to do, I think they're starting to get that, I mean I'm sure they're already happy but it's being reinforced so I think it's a long term benefit of what I'm doing.

Thanks.

I think my having an impact on the students at the high school level usually every year there are one or two kids who say, it looks pretty cool, the one thing I would say is that I'd probably have more of an impact if I were a female, because we had a field trip up here and the girls in the class one of them commented about I already feel like a minority because there aren't many females in the physics class and coming up there it's, I certainly didn't see anything that would make me want to be the only woman to be in an engineering course and I never even thought about that, the teacher hadn't thought about it so next time I give a tour, I'm going to give a representative from society from engineer's _____, this is probably the time to say that they should be recruiting more female fellows.

How do you think you have impacted the teacher you work with?

Since you bring it up Brian, I think I have impacted my teacher, and part of that is the foundation skills that I know the students really need. The teacher has been scared away from teaching students how to really spend time taking notes on the board, which isn't as fun and it's not the perfect system to do all the time but now it's not happening at all, and I said wait a second, if we're trying to get students to go into science and engineering that's a skill that they need, so we're doing that again, and we're going back to square one and

saying this is how you take notes, this is how you find a topic sentence in a paragraph, and we're teaching that in science because they're not really getting it anywhere else, so I would say that has definitely been an impact on the teacher and the students as well.

So you sort of model the work of basic skills, that's interesting.
This is what I really needed to get through, everything that I did in college and graduate school so if that's where we're trying to get students they need to have the fun stuff…

So in talking about the program, how has that gone this year? Last year communication was a huge issue, I would say you were like oh it's not that big of an issue but it was clearly a big issue, people were frustrated that they weren't getting notifications in a timely manner, they didn't know what was expected there was a lack of clarity and what the program expected fellows to do and when and so on. How are those procedural parts of the program going this year? You(to one group) have a frame of reference, you guys(to another group) don't, but what would you say?

I guess for me I certainly had issues at the beginning of the year with people didn't know what their roles should be I guess it was worked out so that the teacher and I came to an agreement, I don't feel like I know more about the program now that I did then though, on a piece by piece basis you have to work it out amongst yourselves and I personally prefer less oversight than more, I don't like people telling me what to do, I guess I would prefer to have less rather than more, so I'm not complaining about it, it is kind of open ended.

I agree with that big time, in the beginning of the year I was unclear on what I was supposed to do and I remember talking and I was like, well what do I do, they're like, well, whatever you want, I was like, well what does mean, I didn't ever get the feel of it until I went in and actually started working things out with my teacher. I agree that it shouldn't be structured, because it's going to be different for every classroom, what's going to work well with one teacher won't work well with another, you should be able to go in and figure out what works for your classroom with your teacher, I guess is a good way to do it. I guess I wasn't clear at first.

It doesn't seem to be an overabundance of communication but I've been very able to get answers throughout the year when I was concerned, there were various personal things that came up with a teacher who I was working with that changed some of our plans and a lot of the work I did was supporting what they had to get through when they was back, so I was worried that that would be a problem that I wasn't doing any extra sensor stuff and I asked Dr. Vetelino about it and he said that's fine and that's all there is to it, I'm very happy with that. I do wonder if the journals are good that we fill out biweekly it's helpful for me to sort of reflect on what I've done and physically write down what I think is going to be happening next, so, there's no complaint with that, but I have wondered whether it's useful to anyone else, and if so it would be nice to get some feedback, you know yeah this is looking good, this might be a problem, if everything's good it's nice to hear that it's good, I'm assuming that if there's a problem I would hear about it.

Well I mean we had a manual at the start of the year and that's something we never had before, the one comment on that is that I don't know if it was emailed to all the teachers, the RET's that were here last year, and they see it and they're like oh this is what's going on at least as a frame of reference. The meetings have been announced in advance more than they were in the past, so that's been good and when modules are due we get a sufficient reminder, when journals are due there's no question. I think it's improved, at least from Joe's end, you know the program manager and same with the PI, it's my advisor so there aren't

many surprises, so it hasn't been like, oh you have a meeting, you've got to come today or tomorrow and so….

I know in the past there were instances where people, we'd get an email saying that we had to be at a meeting tomorrow, or else, but that hasn't been the case this year.
No.

I think that one instance, not the meeting but make sure you are here today is the point, at times it worked out and it was fine but, there would have been days that I would not have received that email until the following day, but I don't get the impression that that's the norm, can't really complain. A different kind of communication thing, My teacher has mentioned she did not clearly understand during the summer that there were a few sides of it; basically the principal didn't know I was coming, and that was a bit of a problem.

I remember our fall conversation.

It would probably be nice, a technicality, but it might be nice for the program to write to the [school] administration saying you know this is what we're hoping will happen and we appreciate your cooperation and that sort of thing and the hope is that the school's are benefiting from us but it's also nice to do the polite protocol and we're hoping to be here, thank you for your cooperation. My teacher also recommended as the end of the year's approaching it might be nice to receive a letter from the PI's of GK-12 to write to the school board, saying thank you so much for having us this year, we hope to continue again with a few technicalities, thank you can go a long way.

Ok, that's an interesting point. Other ideas, other thoughts?

I guess I started last spring I didn't think other than, I really liked the reminders from the Yahoo group, that helped me out a lot, to figure out when journals were do, cause the year before I had to keep track. I think everything's fine, I haven't had any problems this year or last year I think everything's been great.

Ok, so I'm sorry if people had something else to say, but communication has been getting better than in the past and have people been able to get issues resolved in a sufficient manner, has that gone ok this year, has there been anyone that's had major issues with getting questions answered or resources or, these are all things that I've heard about in the past from fellows.

I haven't had any problems.

Ok, so then the last section of this, how is this program affecting your progress in your own studies, your own PhD work and I'll just stop there I can add more prompts if I need to, but I don't think I do.

I know for me it has added a least a year to my expected graduation date.

I love it lot and I'm not saying that I would do it differently but it definitely slowed it down, and I guess a suggestion, in the other GK12 program that I was in, I was in a different program last year, one thing they had the fellows do was that the fellows were not in the classroom if the University of Maine was not in session, so that gave a few weeks at Christmas and then we didn't go past the finals week, and the reasoning was that those are prime time for grad students to do their research, when school's not in

session you don't have classes, and I have found this year that the fact that I was in the classroom and it's definitely going to affect how much research I can get done during those prime research areas.

Are you guys there right until the end of the school year?

Yeah.

You're scheduled now right through the middle of June, cause of all the snow days.

I leave a week early because of a conference, but it's just a week.

Actually that's a question I had, I'll be missing two weeks next year during the February break, and I don't need the question answered now, but it's a concern that I don't have any standard protocol to know, is this ok what do I need to do, and that's a bridge I need to cross but I just want to put it out there in case it's something that should be standardized, maybe it's fine.

I think it's always been case by case, last year when Wade was a fellow, I don't know if you know him but he had a conference at the end of September basically he didn't go to school until October because he was preparing his poster and his paper and he was in a paper competition so he felt it was important, so he didn't start until October. Of course he talked to his teachers about that.

Slowing your research down?

One of several things yeah, definitely it's not speeding it up, it's time spent away from research.
It's only one of the several big side projects.

It adds time but is it worth it?

Yeah, it's a good experience and teaching at any level is at least helping you to at least put together a portfolio which a lot of PhD students won't have.

It's the first thing that comes to mind for me, is that it's slowing me down, I was a little worried, but I had a conversation with my advisor earlier this semester, he said yeah I recognize this is a time commitment, but no concerns so if my advisor isn't concerned so I'm not concerned. I don't really have the motivation to rush through my research; I'd rather take my time and do a good job with it.

I agree, if your advisor at school were paid to do it as a free grad student as far as if you were going side, for your case you're not a paid grad student, that's great for them, you're only going to be there three to five days a week to do research, who cares how long it takes you to research if you're a free grad student but in our case, where I'm kind of working under… there's no real time frame. I'm only doing a master's, that's not going to take me seven years, my time frame is maybe from two to three years but I don't mind, I don't see what the rush is.

We can still get paid, and miss two days a week.

Is this a good gig?

Yeah this is awesome, I can't complain at all. And if other people differ that's fine, I don't mind being slowed down because I'm still, school's free, and I feel like I'm only doing two days of work a week for a paycheck.

Yeah when I was on RA for an external company it got to the point where we were so busy I was working forty hours a week and not everything you're doing there is directly related to your research. Some of it was, and some of it wasn't. There are always things that are going to take away time from your research depending on the funding. I know some people who are TA's, they pay them 11 grand so it's awful. It's slowed me down and prevented, and I have some personal goals; I want to publish a couple papers before I get my master's. I hopefully will be finished in December, so I have most of my research up to this point. I just need a month or two months worth of effort to have something publishable.

Your focus is on battery efficiency or power management efficiency?

Yeah, minimizing power consumption. I'm one step behind and I just started it recently, I'm just getting to this area of my research, maybe two or three months ago. But the stuff that I've done prior to that some of it maybe in about two months maybe I'll have some contributions because I've been able to get some stuff. But, it has slowed me down, hopefully over the summer I'll have some stuff that I can do and publish, so it's going to set me back a little bit but I'm not complaining as far as that goes and I know that it's not required that I publish anything in order graduate but I feel it's taken a backseat.

how are you?

Wonderful.

You've caught on to what the question is?

Yeah, it takes time but I'm used to it from last year, trying to manage everything and it's definitely worth it, having NSF behind your name several times, but also the experience teaching, and it takes up time but it's just a balancing act, figure out the balancing act. I have other stuff that's just a balancing act. Takes up time, but what are you going to do, it's a great program and I wouldn't have it any other way when I'm grading papers for a 100 level lab and get paid half as much and do a lot of work just grading things rather than being creative and coming up with labs and making a difference.

Any other concluding thoughts?

Just one. What _____ said, I hadn't thought about it because it's two schools I work at with I have full support from at least on school administration, if not the school board. But it would be nice for them to get a letter saying thank you for your time.

Even though the communication not being perfect to you all, you all can be flexible about that because you're getting paid and you work for the outcome, but for the schools that are cooperating there should be a higher level of communication?

Yeah and I think one letter would do or one at the beginning of the year and one at the end of the year. Some other feedback though, _____ showed me the letter that she received, looking for new RET's for

this year, and she felt that it was improved upon from last year making things a little more clear, so good job on that.

End.

Section 8: Cooperating Teachers Post-program Survey

Teachers were surveyed again in May of 2007 and several of the questions from the fall survey were repeated to detect shifts in participants' attitudes and perceptions. When asked how difficult it was to supervise the Fellow(s), all responding teachers indicated it took *Little* to *No time and effort*. Most (90%) of responding teachers felt the program would improve their teaching effectiveness, and eight (80%) indicated the program would assist them to some degree in aligning their curriculum to state standards. Similarly, eight (80%) of responding teachers said their involvement would help them further integrate technology into their classrooms. Three respondents (30%) suggested the presence of the Fellows would *Greatly improve* the motivation of their students to study STEM, and another six (60%) indicated it would *Somewhat improve* their students' motivation. Finally, when teachers were asked to characterize their overall experience with the GK-12 program, nine of the ten responding teachers said it was a *rewarding* experience. Only one teacher indicated it was *neither rewarding nor disappointing*, and no respondents said it was a *disappointing* experience.

When teachers were asked to write about their experiences with the GK-12 Fellows, they shared many positive experiences. Several teachers wrote at length about the positive difference the Fellow had made for students in their classes. Other respondents mentioned the quality of the instruction and ideas the Fellow brought with them. Still other respondents referred back to the positive summer research experiences they had. One respondent was not positive about the program, and indicated the only benefit received was the stipend. This response is not in agreement with the majority of teachers' perceptions, but signals a potential breakdown in communication, conflict, or issue to be resolved.

Section 9: Teacher Survey Summary of Results May 2007

		N	Percent
Have you been able to incorporate information or techniques you learned last summer into the classes you are teaching this year?	Yes, a lot	2	20%
	Yes, some	5	50%
	Yes, a little	3	30%
	No, haven't been able to		0%
	Not this semester, but plan to next semester		0%
	Probably won't be able to		0%
How much time and effort do you think it took to mentor the graduate Fellow(s) you work with to improve their teaching skills this year?	Considerable time and effort	1	10%
	Little time and effort	7	70%
	No time and effort	2	20%
To what extent did your experience with the RET/GK-12 Sensors projects this year improve your own teaching effectiveness?	Greatly improve my teaching effectiveness	1	10%
	Somewhat improve my teaching effectiveness	7	70%
	No change in my teaching effectiveness	2	20%
	Decline in my teaching effectiveness		0%
To what extent do you think participation in the RET/GK-12 programs this year helped you align (or maintain the alignment of) your curriculum with state, local, or national standards?	Will help significantly		0%
	Will help somewhat	7	70%
	Will help only a little	1	10%
	Will not help at all	2	20%
To what extent do you expect participation in the RET/GK-12 programs this year to help you integrate (or further integrate) technology into your teaching?	Will help significantly	4	40%
	Will help somewhat	5	50%
	Will help only a little	1	10%
	Will not help at all		0%
In general, what do you think the impact of the GK-12 teaching Fellows was on the students in your classes this year?	Will greatly improve students' motivation to study STEM	8	80%
	Will somewhat improve students' motivation to study STEM	2	20%
	Will have little impact on students' motivation to study STEM		0%
	Will reduce students' motivation to study STEM		0%
Overall, how would you characterize your experience with the RET/GK-12 Sensors programs this year?	Very rewarding	9	90%
	Somewhat rewarding	1	10%
	Neither rewarding or disappointing		0%
	Somewhat disappointing		0%
	Very disappointing		0%

Section 10: Teachers' Qualitative Responses Post-program Survey:

Praise:

- I appreciated the work the work that my Fellow did for my classes, he was well prepared and the lessons worked nicely with my curriculum. I think that overall the students liked the labs and interacted well with him. Some of the students gained a lot just by asking him questions about college, research and engineering. I'm looking forward to working with a GK-12 fellow next year.

- I have had a wonderful experience with the GK-12 program. My current Fellow brings so much to my program. The Fellow's interactions with the students were very productive. Often, we had to rely on the Fellow to push us through tough spots in our work. The Fellow was very organized and had a clear vision of where we should be going.

- This is an excellent program that has challenged students and inspired them to seek careers in the technology, engineering, and scientific field! While my answers above reflect my true belief about my teaching abilities and how the program interacts with me, I feel that I should elaborate more. This is my 4th year into the program so the direct impact to me is less each year. This is also my 26th year of teaching and I have always used available technology in my classrooms as they have become available. That is why I was selected for the program in the first place. The true impact and measure of the program is in the students and year after year it is the same. They look forward to the next visit of the GK12 fellow each time and the challenges that they bring. The responses from kids and the peaking of interest in scientific endeavors is priceless!

- This is a program that truly impacts children's lives in a positive, lifelong way!

- On the whole I think the program is well run and very beneficial to my students.

- My Fellow is a natural in the classroom

- GK-12's are more than just a student from the University; they become role models for these students and help to encourage them not only in science and technology, but also in everyday life. I would like to see more access to equipment form the University; perhaps a library checkout system would work.

- I must note that I think the GK-12 Fellow assigned to my school is an extremely hard worker and is a model fellow. He is the third fellow I have worked with and I hope his 2007-2008 assignment remains the with my school

Suggestions:

- We need more time to work with the GK-12 Fellow to plan out activities. We get one period to talk and plan every three weeks. It is just not enough time.

- Perhaps a GK-12 from another middle/high school could come and share what type of research they are involved in at the University. This would give the students more exposure to other types of research and possible jobs for the future.

- I recommend that sensors be acquired in sufficient quantity to enable a class to have hands-on experience.

- GK-12 Fellows & RET's should attend a lecture/workshop on using the principles of backward design, where we would focus first on the learning goals (understanding goals) and then derive the Sensor Lessons from the evidence of learning (performances).

- Outline specifically what you expect from the GK-12 Fellows and the RET's so that they do not get frustrated with each other. I don't think the participation from both perspectives (GK-12 & RET) is consistent across the board. Therefore high school & middle school students are not receiving the full benefit of the program. Some culling should probably take place (both RETs and GK-12) to make sure the program is doing what it is designed to do.

- Keep the graduate students with the same teacher as long as possible. It helps establish a good working relationship. It also gives the grad student a better idea of how the school operates. It helps the grad student and the teacher learn together what works and does not work in the classroom.

- The program should purchase sensors so they can be used in the classrooms.

- Fellows need more training in classroom management skills prior to the beginning of the school year.

- Fellows need to be in classroom more often, at least once every two weeks.

- More time needs to be allotted for teachers and fellows to plan their curriculum together prior to the beginning of the school year.

Section 11 Teacher Focus Group Fall 2006 Edited Transcript
GK-12 Teachers
10.24.06

Let's just start broad. What's happening in your classes so far this year, with respect to the GK-12 fellows and their work?

Well, this is my third year. My first year we started off strong and then last year was nothing. And this year has been phenomenal for our GK-12 fellow, has been great. He's been amazing. He's very flexible. Him being in food science, too a lot of Biology aspect, quite a bit. Very willing to do anything like, "What are you doing? What should I do?"

Does he help you with your curriculum? Does he follow your curriculum?

Yes, he does. We say what we're doing, and he adjusts. And what has helped him, too, is he had done another GK-12 fellowship as well, and he came from sort of a different perspective there, which was good. I think he's sort of ahead of the curve. It's hard to walk in and expect a GK-12 fellow to be able to teach, and he had that behind him already which was good. He has a really good rapport with the kids. Everyday, they're all, "When is he coming in again?"

I think its variable, and our experience has been, who are GK-12 fellow is. The year I had _____, I thought he did a great job working within my curriculum, and this new Fellow's off to a similar start. Frankly, last year when I saw the pool available for Bangor, I said, "No thanks, I'll do some of the activities that another Fellow and I developed on my own". And that's what I did to keep something going with sensors and some cutting edge technology. Just knowing that particular person, I didn't feel I was going to make much of a connection with myself. And then, if as an individual, I can't connection with them, I wonder if my kids could. So, I just sort of backed off last year, and that worked for me. And this year, was really excited to have my new Fellow.

I'd like to add my thought to the idea, that who you have probably is really key. And I've had my Fellow for two years, and this may be his third year doing it. I'm not sure. He was a veteran kind of leading me along last year in some ways. And Joanna and I share a class and she may have some different perspectives, but as he was last year, he's been excellent this year. I think my issues with him are a lot more on timing and some other things that I'd want to talk about at some point, but certainly kids enjoy him. I enjoy him. He does an excellent job at getting in touch with me, asking where do I think we will be and you know and he'll try to do that three or four days ahead, and check in and make sure we're still on target. He brings in appropriate activities.

To match your curriculum?

Yeah, he knows the kids names, this fall more quickly than I have learned them, and is doing that with very sporadic attendance. Couple days one week, another day, two weeks later, and so forth. And I do get faced with, "Oh you're here, we thought Mr. French was going to be here today" and that's a nice thing for the program certainly, and I'm there as part of what he does,

and if they don't like him because they run rampart, which middle schoolers will do, but they like him because he brings interest in things that do fit our curriculum and can bring some resources that I don't have in my old closet.

In terms of what Georgiana was asking, I have felt in general that he is with my curriculum as much as I come up with all the ideas. So that is a little bit of a challenge, because I do want the control in terms of maintaining my curricular path, but I also have felt in general, like if I don't come up with something, I don't get something. I'll usually come up with the idea, and then he'll make it happen, which is definitely worth a lot. Another thing is that this year, he's doing our physics classes and our chemistry classes, so he's with Deborah also. So that means I see him two days in a row, once a month, which is about the right amount. I was having a really hard time last year, cause he'd show up one or two days a week for a month at a time, and it was just too much. I couldn't just give up two days a week to just do whatever. I just couldn't really do that. So this works better, and like this week, one of my classes, I'm just not at a point, where I can take break. Cause the day that's he's going to be there, cause he has a class, so there's a course conflict, the one day he could meet with them is a day we're testing and we have to do that, we can't put it off. So I just said, this time you're not going to see them (him?). So it's a hard thing, because I feel like from my side, I get frustrated when he cancels, but from his side, I'm sure he feels frustrated he's under utilized. It's definitely a little bit tricky. And Deborah is working with him also.

How's that working?

It's only been a year. The two times he's been is has been great. The lab we worked out was one that I had developed, or looked into developing this summer. It worked out very well.

So there was some follow through from this summer?

Yeah. Definitely.

I've worked with Jason, along with Tracy and Tricia (?) and he's been great. Last year, the experience wasn't as worth while as this year. I feel like Tracy and Tricia said, he's very organized and willing to come in as much as possible. He's been great with matching my curriculum and the Maine Learning Results as well, which I've been really happy with, the two labs that he's done have aligned really well with the 8th grade science Maine Learning Results, which I'm happy about. I hope that that continues. That's about it.

Other thoughts? Dave?

Mitch is very enthusiastic and very big on regular communication. He's very a very positive presence in the classroom. Very flexible, very open. He can stay with curriculum idea and can generate his own as everyone has said. It's still very early, and we're off to a good start and he's already kind of jumped down the hall and worked with a couple of other teachers as well. So, he's not just going to be in my room, but it will go beyond my room. I'm happy he's doing well.

Ted?

I work with Jesse Parks. It's the second year I've been doing the GK-12 program. I started with him last year. It was a little rough as far as scheduling and consistency, and coming up with ideas to do things. But this year's been much better. He's likely to come up once every other week, is a good timing for him to be able to do something that's sensor oriented to the earth sciences that we're talking about, whether it's making better telescopes or whatever kind of sensors. So he's been great. The kids love him. He's high energy. So, I've been much happier this year than last just as far as the scheduling and working out expectations.

And you worked with him last year, too? So what's the difference?

He knows the expectations. He knows the routine. I think his schedule is a lot easier. He doesn't' have any classes. So, he's more regular. I remember, I think I saw him twice the whole first semester last year. Maybe three times. This year he's been in every other week. He comes in regularly. I don't remember labs we did last year. He's got the stuff. He's done a couple new things. Like I say, he's good with kids. The kids like him. It gives them a nice break.

Is he working with other teachers in Bangor High school?

Yeah, he has gotten himself wrapped up with another one of their science teachers. He made an effort to get over to the other side, Jim Smith's group. I understand they're not too pleased with the program, so they've kind of said, "See ya".

Does anyone want a chance to share about what they're thinking about this?

I have an opinion. This is my third year. My first two years were very very successful. I worked with Eva. The kids loved her. Again, "When is she coming?" They actually last year applauded when she came and left the room. They loved her so much. This year I have anew guy. I think he's new to the program, Don, and he came in and did an awesome GPS activity…one of the ones that developed in that menu of things we have to choose from, and he actually (it was for Social Studies as opposed to Science cause we were doing Geography), and did all the six grade classes, so instead of just doing mine one class, he touched base with all the teachers. I have an issue this year, because I received an email stating that the GK-12 program is not in existence to supplement my curriculum, that they're not student teachers. That they're not there to support my curriculum. They're there to do other things as scientists, engineers, and researchers. So, I was really taken back by that, because my first obligation is to my curriculum, and if they don't want to work around my curriculum, then we need to sit down and talk. Because I don't have time, not to have it. I would think in science, there would be no program figuring how sensors apply to science in anything…earth science, no matter what it is. I don't know where this "We're not here to supplement your curriculum came from", but it wasn't just from my fellow, because he went back and talked to Vet and Joe and emailed me today and said this place in the classroom is not to supplement my curriculum. And I have an issue with that.

I don't know. I'm stepping out of my evaluative role here for a second, and stepping into moderator role. It may be a difference of Lexicon (??) and it may be that when you have a

discussion in the next hour with those people, that you may come to a different understanding of what they really mean by that. So, I don't know. I'm not going to try to answer for them

I have been very confused about some of the emails that have been going back and forth and I think some people are getting upset about some things that I could get that. And then there are other things going on that none of us have any idea about. I mean, I know there are something going on **** and for those who's this is our first year out of the major summer program. Like, I was never aware that there was a stipend in the years after the first year, and there are a lot of people complaining that they've been discontinued. So for those of us who didn't even know it was there…you know.

There was a stipend the first year for our time, for coming to meetings, for supplies or whatever. It was $1,000 stipend and they've done away with that. They haven't included.

That was last year?

That was two years ago.

Okay, so no one was getting that last year either? So I wonder why everyone's so upset now in particular.

Well, they found out this summer that they weren't getting it?

Oh, so it was after the fact?

Yeah, you get paid after the fact.

Oh, well that's kind of rough after the fact, they know.

But, that whole idea of communication has been a problem for me, because I worked this past summer in the RET program, and in the letter of acceptance it didn't say that I was going to have a fellow, so when I showed up at the beginning of the school year with a fellow, the principle at my school said, I didn't approve that. And I said, Okay, now what? So I had to go to the school board and get their permission. I'd had a GK-12 fellow for the past six years through Susan Dwelley's (name?) program, and I didn't have to do it through that, but I now had to do it. And if I had known about it ahead of time, I wouldn't have bumped in to that wall, and it turned out to be a real headache. And it's been a real headache in terms of scheduling, because I couldn't' schedule. The fellow that I have is taking classes in the morning, so she's only available in the afternoon, and I have back to back science classes in the morning, so I've had to do some switching to see if I could get other grades in the afternoon. And "no, because she's not approved by the school board, so we can bend for that". It's not this program, but if I had known that I was going to have a fellow back in June, I don't think I would have run into all this bull shit, to tell you the truth.

Yeah.

I'm Brian Doore. I'm doing the evaluation. I'm part of the program. I work with them, but not for them. And so, we're just talking about this implementation…how this is going this year. Concerns and positive things, and …I don't know your name, so if you could tell me that.

I'll be positive. I'm an RET from three years ago. John Mennette. Aaron Clark has been working with me in our school and (name?) at the junior high school, and he's done a fabulous job. The kids love him…his real openness. We've brought a lot of students to the university. All in all it's been very positive. He's been a very positive role model and been a great help to the school and to the kids. He's very adaptable. He floats everywhere from biology to chemistry to physics to earth science, to the junior high class to whatever they're doing up there to just sort of motifs into whatever needs to be done, to get the with kids where they're at, so they can see a scientist in action. So, by far I've been very very pleased with it.

Okay. You started to touch on a lot of these things. I'm going to skip down a couple of questions. What in general, has exceeded your expectations for what you thought was going to happen for this program so far that you haven't already said?

Enthusiasm from the kids has been incredible. I think that's the most impressive thing for me.

The things I was able to offer the kids because of the things that Eva came up with to do with them were things that I didn't have in my resources.

The access to materials, I think, has been great. To bring in liquid nitrogen and different types of materials for class that otherwise, we wouldn't have been able to offer the kids. What Jason has been able to offer has been nice.

I have Christy and she's been very flexible and patient with all the walls that we've bumped in to and she's the one who planned the Diver Ed. Field trip that was terrific. It was absolutely terrific. There's a pier in the College of the Atlantic. We went on a boat with this guy named Diver Ed, and we went out…not too far, and sat down an anchor and he suited up and talked to the kids while he was doing it. Then he went over board and let one of the kids push him, and went down and collected some stuff while the captain was explaining. And it was pretty goofy, because they had Mini Ed that was a little toy, and you kind of look and say, that's nice and everything, but then he takes the camera down and walks along the bottom and the kids are watching the projection up on the screen in the boat and they're looking at something and they'll say, "Whoa look how big that is". And then he takes the little toy, and say's "Oh, look Mini Ed wants to see" and the kids are watching and all the sudden you get a sense of scale because they saw the toy already and then they see it next to a sea star and so they get an immediate sense of scale. Then he collects some stuff and they say, "Oh get that" and he collects it and then he brings it up on top and they get to look at it and feel it and touch it, and look through it. And it was great.

How much was that?

I think it was pretty expensive and this program paid for it, the whole thing. Paid for the bus, paid for Diver Ed and we went to the whale museum, and they were boiling bones and that was

nasty. It was a really rainy foggy, not such a great day. And the next day, I said to the kids, "did you care that we had bad weather?" And they said, "Huh?" They didn't care. They were so focused on what he was doing, and when he was under the water. It was amazing. Evidently, he rents docs *** from them. He took some of the things that he collected and took them back for their touch tank, so there's a connection there.

I think you could find him through the Chamber of Commerce, and on the web, too. He used to share the pier with *** people, and you'd get tickets through them, but he doesn't for whatever reason anymore. But, he's good with groups. I don't know what he would do with group rates, but I think…

He did something with group rates.

The only problem is, the boat is small, so you could only take 20-30 kids max.

How many kids would you really want on a boat?

Well, you wouldn't, but just in terms of planning a class trip. It would have to be small.

But, it was amazing. It really was.

Thinking about your question, about what's exceeded our expectations. I am not sure about the rest of the group, but I had relatively high expectations to begin with. In fact, I found it difficult to continue, which I think, I'm feeling, if they were meeting them, it wouldn't be something where you take on a student teacher and you have to nurture them. Certainly some of them. But, these people have to hit the ground running and do a good job and I expect them to do a good job. So a lot more of my thinking about it, or when all of the sudden a little glitch, or when something slips up a little bit, because when things are working well, they're working very well, and so because I don't speak about exceeding expectations, it doesn't mean they're not a very high level, which I think they are.

That's a nice qualification, thank you. Alright, let me turn this over. What's fallen short? You've already talked about a number of things, but are there other things that have really fallen short of your expectations?

I think what we need, the whole thing about communication, is a CLEAR outline of what is expected of the teachers, and a CLEAR outline of what is expected of the GK-12 fellows. I don't think those have been clear.

And also the *** over time, because I know when I started out I knew I was getting a GK-12 fellow. I was very nervous about it, and I thought I had a one year commitment. And I got here and I was like, "Wait a second". And I think that's why all the people are reacting the way they are, cause like, if they're not going to get reimbursed for it, and I don't know. I don't think I was thinking a lifetime commitment. I thought I was thinking a one year commitment. I mean, it should be such a great program that you want to keep doing it, but if it's not working, there's nothing to hold people from saying "Well I have served my one year commitment".

Other things?

There was an attempt made to facilitate an equipment repository? Interschool loan swap access ability ?? by GK-12 sensor students to be able to have a repository equipment to use with students in sensor laboratory experiences. To date, that has not happened. Where that all evaporated to, I do not know. We're making do, because we got resilient, and my Fellow and I worked together to make do with what we have at that time. It doesn't' mean that that's the ideal; it means that we're adjustable. However, as I understood it initially there was a part of the grant was for equipment for use of sensors with students. Again, my concern ultimately bottom line, is how are the students profiting from this experience? Yes the interaction with the GK-12 is fabulous, but what more could be done to get sensors into their hands and to open up some young minds for possibilities for them. That's all.

I guess that, that's one thing I've thought of, is that because there's not a lot of equipment, we sort of are a little loose on our definition of a sensor related activity is, which may inspire negative reaction from the folks here. But, we're not going to come up with *** to show the kids how they work. You can only talk to kids so long about "There are sensors out there that do this". My kids are excited to see Les after he's come a couple of times, but they've only met him once. They're not excited to see him again, cause the first time he did a presentation, and they think he's just going to do presentations every time. So, we do have some sensors at our school, but there are some things, I remember hearing there was somebody who was doing those little Lego robots you could…I thought that was something GK-12 owned and I asked Les if he thinks so, "No".

I haven't seen them. Because that was something I was interested in. They're expensive.

Yeah I thought it was something that GK-12 owned that we could share for different parts of the year, but I misunderstood.

I do think it would be very helpful if we get a very concise and clear statement of what their obligations are and what our expectations can be, because I can remember sitting in meetings last year when we were trying to divide up time, and in my mind thinking, how much demand can we put on this person. Then later on, not because anyone planned on us knowing, we begin to have a feeling for what in fact the fellowship means for him, in terms of financial *** and so forth, and you think, maybe we should be making more demands and not be so apologetic about the time and so forth. But nobody, at least for me, could define that and look back in my handbook and say "you can clearly expect fifteen hours a week or more if you need it".

When a fellow misses a day, I have not seen a fellow make up the time. And there have been a lot of missed days, although not so much this year.

Just on the other flip side of that, I have had my fellow make up the day if he missed a day. I gathered from *** we know that our objective was to have the RET of the GK-12 fellow merge and work that dialogue out between themselves. It wasn't really formatted in black and white but rather interactive thing going on between the teacher and fellow. That's the way I've done it.

It wasn't a clear definition, it was a matter how can you make this work. It was more of an overarching directive than it was a detailed sequence or methodology.

And sometimes with the right personalities that's going to be fine. But there tends to be a little too much grey in those kinds of arrangements and personalities form the teachers, personalities from the GK-12 fellows and expectations. It caused me to just back off last year and say "That's not a personality that I think I'm going to be able to come to that professional congenial agreement". So, it was okay that I didn't do it last year.

I think that model would work very well if you were one of the first people on the bus as it's rolling along. But if you were like many of us who got on the third, fourth, or fifth stop, then *** what happened up to that point. A lot of assumptions are made because you've been in them for a while, and you've recycled and worked it through, and those of us who are newer are sitting here and saying what we really….our obligations and what we obligate them to, whether it needs to be etched in stone, it certainly needs to be clearer than what it is now. It needs to be **** you go back and say, "This is a minimum we expect, and what you can expect from us".

We're drawing into the last ten minutes of the time I have with you. There's a couple of other key issues, I want people to have a chance to speak to, and it ties together so you may have a chance to share more other things and weave them together. What should the program look like? In other words, how would you change it or modify it? You can speak to the administration of the program. You've made some suggestions for clearer guidance, lay out this, lay out that, but under an ideal circumstance, what would that look like for this person to be coming into your classroom? What would they be doing? What would they be providing? What would your students be getting? If you can imagine that.

One suggestion I would like to make is that some teachers should be invited when they pick these GK-12 fellows as GK-12 fellows might see the applications of the teachers they choose.

So screening?

Yeah. I don't know what criteria they are using to pick these GK-12's. When we as teachers, we're fingerprinted….I don't know what criteria they are using. These guys come into our schools, and that's why you're having so many troubles. And today with all the school shootings, all the stalkings, all the stuff like that. It's just something to keep in mind. That's an extreme example. Also the ability to relate to kids, coming down on the engineering thing and be able to laugh and communicate with kids. It's a quality.

Maybe some classroom management training or something like that. A little two-day seminar on strategies and techniques to manage a classroom.

So could the program contract with you teachers to do some of that?

Sure, I don't see why not.

For pay of course.

The thing I wonder would be interesting is, when we get into thinking in terms of, which I do sometimes being a new teacher and not getting paid very much myself, get tot thinking, they're getting paid "this much". They should owe us "This much". Keep in mind; these fellows are getting paid more than I do working full time. Then it seemed like you might get more applicants if it weren't such a big time commitment for them. And it might work better in the classroom because I don't really want someone two days a week all year. And once we start spreading them between three teachers, they start to feel spread thin, you know? Without it being like, because they're spending a good deal of productive time, just feeling spread thin because they're trying to coordinate with three teachers. But I almost wonder if the time commitment and the stipend were cut, if you might get more applicants. Because if I were a PhD or Master's student in engineering, I love kids. I think this is a very poor idea. If I were an advisor, I don't think I would want my students doing this. It's too much of a time commitment.

A lot of the problems come from scheduling.

Two days a week is a lot.

And some of the expectations are not clear.

We don't know the standards.

We were told it's supposed to be ten hours in the classroom a week. That's their standards. So, between the three of us, have that covered, but I only see him once every other week.

And that works fine, but he's serving three of us so he's making his quota of about ten hours a week, but not in any one classroom.

But, he's not spread around three schools either.

No, two. So, he hits two schools. He has a good pretty good schedule, and it works for us because I can't, like you Joann, I wouldn't want someone in twice a week. I can't do that. I can't make it meaningful. I can't keep to my curriculum that my testing constrains.

Every school is a little different, but there's certainly a compromise somewhere where it's just he right amount. That may not be the same in every circumstance.

And I mean, if you guys have three different people for the same amount of time you have now, that person might be…it sounds like you have a very good person. But if you had someone who wasn't as strong, they might do better to have fewer placements in less time over all.

You might think a little bit, too, about the middle school, high school continuum. In other words, in our circumstance, Les has come to our middle school and the high school we send to. Not everybody is capable of doing a nice job and feeling comfortable. That's a fairly large group to come off and ask teachers to teach sixth grade advanced senior classes and so forth.

Just a note on that. First of all, I concur, we do that at my school, which is a middle school. It does work as far as the continuum going up through. We split it so that Aaron is at the middle school maybe once a week and he may show up twice a month down at the high school now. It used to be the other way around. The first year out, he just did the high school, but since then he divides up his time, so he's all over the place. So it works perfectly. If the GK-12 fellow take the initiate to distribute their time, work with the RET's, then the 10 hours a week is certainly not excessive, based on the amount of *** that they're getting it's probably not excessive. Another point I wanted to make: They are not there to teach your class. They are there to present as a scientist a new way of looking at things and the excitement of science as a model of what kids could be, and we really need to be careful that we don't expect them to come in and "teach" a class.

We shouldn't be leaving them alone.

Never. We should do all the student monitoring as far as all the behavioral aspect. We automatically do that.

It might be a good skill for them to have a little staff (?) in your class and stuff like that. That still is good.

Especially, as you pointed out about the ***, how do you get down to the kids level? How do you speak with kids in meaningful ways that you connect?

And some of the GK-12 want to get called by their first names, by the kids and stuff. And I just feel that that's opening things up for a different level of…they need to see this person as a professional. So, just some of those sorts of things that might be good to circumvent by meeting with them or having some sort of seminar, like professionalism and teacher protocol…for the lack of a better word.

Well, I think there's no question. They have got to meet the school's expectations in those circumstances. It wouldn't be their choice at my school, I don't think. If they want to be on first name basis, they'd have to find another school.

*Alright, let me ask a different question. I'm going to physically turn my focus to *** prompts. That doesn't mean I'm not including you. I just haven't heard much from you folks down here. And that's fine, you don't have to say anything, but maybe I'll try asking a question in a little different way. What are the things that your fellows are particularly good at? Or, I'll let you tackle this at the same time. What are some of the most frustrating things that they do, or don't do?*

My fellow is very energetic, and that is contagious, so that's very good. He has also admitted to both me and to the kids that he is learning a lot, because biology the second time through, he's seen things that he didn't understand how a microscope worked. He uses his research tool, and all the sudden, he's like, "Oh that's what that thing does". So, he's having a lot of fun with it, a lot of honesty, and a lot of energy. And he's still young in the classroom, and *** some redirects and some of the basic things that anyone in the classroom would. And one of the reasons I've

been quiet on this end, is I can compare greatly to the program I came from. And since I've been only in this one new and for a little while, I'm just trying to let some of the folks who have done their time with this one, fill in some of the blanks on comparing it to the past.

Other thoughts?

The guy I have, same kind of logic. Very good with the kids, and the kids like him. He can talk just about anything and he will engage them, and get them going. He's good. He's done well.

Is that enough?

Umm. Well, like I said, this year's been much better. We have *** expectations, and he comes in, and I don't expect him to teach the class, but he comes in and gives a perspective of what a scientist or someone developing sensors does. So he brings in all these gadgets that they have never seen before and he makes them work and apply to what we use today for sensors. So yeah, both from a technical standpoint and from working with the kids, I've been much happier this year than previously.

I think something great that's been going on with my fellow that he makes the lab experience exciting for the kids. They're science comes alive in a way for them and they get to see things that otherwise might only being coming out in a lecture format or something like that. I think that's great, and I want it to continue.

What should this program do for teachers?

Help keep us current.

Help bring something to the classroom that we don't.

Enrichment via curricular enrichable resource ***. To bring something in that we can't (?? Muffled).

There is more. I can see it in your faces.

I think that James' point of keeping us current is very important, because a lot of times we're bogged down with assessments and all this other stuff and we don't get a chance to see what's new and out there. And that is what these kids do. They bring that into us.

Give us a new perspective on science in general. I think, and Tracy said this earlier, the great thing about the fellow that we have is he's coming from a food science background, which a lot of kids, they would never think of that.

They asked me if he worked at Hannaford's. I said "No".

They would never think of food as something you could have a career in science as, and that's nice.

I mean I learn stuff up here. I got here last time, and I was like, "Holy smokes, they do make sensors We're all learning stuff, just to pass a little bit of that onto the kids.

Is there any formal relationship between the RET program and the GK-12?

Yeah, absolutely.

If you went to another place where they…

Oh you mean like a larger one? No They're both run by NSF.

This GK-12 thing and Joanna, kind of came around the back door in the whole thing. And in some ways, I've sometimes felt like this is just a handy way to put your hooks into some people.

Yeah it was too fuzzy and it wasn't in writing, and that's why I had trouble with the administration.

I had another question about should the administration in this program be like, but I feel like that's been pretty well addressed. What the problems are?

And I think that in seeing some of the stuff, I mean, they put into our summer thing. They told us to bring handbooks from our schools. So it's sort of like, they understand, this is an issue, but I just think finding the right format to address it. Because I think some of us are better establishing rapport and some of us just have a better match in the fellow, but in terms of establishing expectations for different parts of the experience.

Other final comments?

I guess I just, with those emails with the $1000 stipend thing. The first year, after worked with the fellow, and it was for our time working with the fellow and supplies we bought and the meetings, and things like that, we were given $1000 and that was three years ago. And I don't know, I guess, most of us, maybe not everybody, thought that was going to happen next year, and I approached them. Really, I came this summer, said, "Are we getting our checks"? And they said "No" and they also said that in the new proposal they decided not to budget money for the teachers. And you know something, I work really hard with ***. They want pictures. I got them pictures, they have to get the photo releases, I had reports *** I did a lot of work last year. I took off from work during the summer to come to the meeting, and then you find that you're not compensated. It's sort of like, "they don't think enough of our time or effort to even think about budgeting in for the next proposal". And when you did find out how much the graduate students got paid. They were getting paid more than I was my first year also…by a lot. I mean, a lot. I was in a poor district, and I was like, "my goodness". I don't know. I'm one of the people that find out. We're a little put back that they don't think enough of our time to even want to put it into a proposal that we get paid the $1000 they gave us the first year for our time that we worked over the year.

You're going to get pizza.

It's going to be cold though. There won't be enough.

I want to get that quote. There was a lot of work to do it, is that what you said?

Well, yeah I think it is. In the course of what's going on. It certainly is, and it's time that we maybe would spend in other ways, like with family or recreational pursuits or something.

Then it brings a lot with it. It's not a time sink (?), if you're getting something for it. But, it's still time that you're spending of your own.

Are there other things that the program could do besides simply paying you the stipend that would also have value to you, and make it more of a carrot(?) ?

I think the professional development for me.

That would be good.

I mean, I'm not going to complain to driving up to UMaine to do something cool. Like, that sounds great to me.

How many of you feel that way, just a show of hands?

I didn't hear what she said.

"I don't mind driving to UMaine to do something cool, like get really good professional development, something in teaching science or using something or other."

And if we knew in advance, I bet our districts might pay for gas, but they probably wouldn't.

I like having a pool of instruments that we could use.

Yeah, enrichment of resources. A bank.

Well, ok. I want you to think of these other suggestions. I'm going to stop the tape here.

Section 12: Middle School Student Responses Pre and Post-program Surveys

Fellows' classes were surveyed in the fall of 2006 and the spring of 2007 to determine the impact of the GK-12 program on students' interest in STEM, and future aspirations to study STEM at the college level. A total of 173 middle school students completed the questionnaire. In general, students' responses were positive with regards to the Fellows' presence in the classroom.

The responding students were enrolled in sixth through eighth grade, with a handful of respondents enrolled in other grades. Most respondents (70%) indicated they planned to attend college, and 19% indicated they intended to pursue an advanced degree. When asked whether they would like to study STEM in college, 41% indicated they would, 28% would not, and 30% were not sure. Interestingly, over 85% of these respondents expected to do *Well* or *Very well* in the STEM courses they were enrolled in. Program staff may want to consider this gap between perceived ability to perform in STEM courses and students' interest in taking them in the future. Part of the answer may lie in participants' feelings about STEM courses. Only 28% of responding students said STEM courses were their *favorites*, while 55% said they were *OK, not my favorite,* and 17% expressed a general dislike of STEM courses. Program staff may want to provide specific professional development to Fellows to help them counter these students' perceptions.

Students were very positive about the degree of impact the Fellows had on them personally. Approximately 60% of responding students indicated they became more confident in their STEM class because of the GK-12 Fellow while only 1.2 % suggested they were *less* confident. Another 55% said they liked the class more because of the GK-12 Fellow, while only 7% said they liked the class *less*.

Section 13: Middle School Student Responses Post-program Survey

GK-12 Sensors! Middle School Student Survey Summary of Results May 2006

		Count	Column N %
Which year of school are you in now?	5th grade	0	.0%
	6th grade	2	1.3%
	7th grade	105	68.2%
	8th grade	40	26.0%
	Other	1	.6%
	Not selected	6	3.9%
How far do you think you will go in school?	Probably won't finish high school	1	.6%
	High school diploma	8	5.2%
	Trade or Vocational School	2	1.3%
	Some college, but no degree	2	1.3%
	Get a 2-year (associate's) degree	13	8.4%
	Get a 4-year (bachelor's) degree	48	31.2%
	Master's degree, Ph.D. degree, professional degree, or other advanced degree	50	32.5%
	Other	6	3.9%
	Don't know	23	14.9%
	Not selected	0	.0%
If you go on to any kind of training, school, or college after high school, what do you plan to study?	Mostly subjects in the mathematics and/or science area	60	39.0%
	Some mathematics and/or science, but it won't be the major area	67	43.5%
	As little mathematics or science as I can	24	15.6%
	Not selected	2	1.3%
How well do you generally do in mathematics and science courses?	Very well	60	39.0%
	Reasonably well	80	51.9%
	Not very well	9	5.8%
	Not well at all	0	.0%
	Varies a lot	2	1.3%
	Not selected	1	.6%
In general, do you like mathematics and science courses?	They're usually my favorites	63	40.9%
	They're OK, not usually my favorites	70	45.5%

	Don't usually like them	14	9.1%
	Never like them	6	3.9%
	Not selected	0	.0%
How useful do you think having these university students in this class will be in helping you learn the subject you are taking?	Very helpful	51	33.1%
	Somewhat helpful	84	54.5%
	Not helpful	5	3.2%
	Don't know	10	6.5%
	Not selected	4	2.6%
Do you think having these University students in your class will change your confidence about doing the subject you were taking?	I always had a lot of confidence in my ability in this area, and it won't change.	48	31.2%
	I will be a lot more confident	24	15.6%
	I will be a little more confident	72	46.8%
	I will be a little less confident	4	2.6%
	I will be a lot less confident	1	.6%
	I never had much confidence in this area, and it won't change	4	2.6%
	Not selected	0	.0%
Will having these University students working in your class change how much you like or don't like the subject in this class?	I always liked this subject a lot, and it won't change	35	22.7%
	I will like it a lot more because of the University students	32	20.8%
	I will like it a little more	68	44.2%
	I will like it a little less	5	3.2%
	I will like it a lot less	0	.0%
	I never liked it much, and it won't change	13	8.4%
	Not selected	1	.6%
Will having the University students in your class change your interest in getting more education in science, technology, and mathematics subjects after high school?	I was always interested in getting more science, technology, and mathematics, and it won't change	36	23.4%
	I will be a lot more interested because of the University students	27	17.5%
	I will be a little more interested	72	46.8%
	I will be less interested	2	1.3%
	I will be a lot less interested	2	1.3%
	I never was interested, and it won't change	14	9.1%
	Not selected	1	.6%
Have you filled out this same questionnaire in another class this semester?	Yes	8	5.2%
	No	145	94.2%
	Not selected	1	.6%

Section 14: High School Student Responses Pre-program Survey

A survey similar to the one described in the preceding section was given to high school students enrolled in STEM courses taught by GK-12 Fellows. A total of 158 high school students returned the questionnaire. The pattern of results on this survey is strikingly similar to those on the middle school survey. The high school students exhibited similar levels of interest in attending college. Slightly over 80% of respondents indicated they planned to complete at least 2 years of college, and approximately 75% intended to complete at least a 4-year degree. Encouragingly, almost 30% of responding students said they wanted to complete an advanced degree. Also encouraging was the proportion (44%) of students interested in studying STEM as their major in college. Both of these sets of numbers were up slightly from the proportions found in the middle school survey. Paradoxically, when asked if STEM courses were their favorites in school, only 29% of respondents indicated they were.

Similar to the middle school students, the high school respondents were very positive about the presence of the GK-12 Fellows in their classes. A majority of students (89%) said the Fellows were *Quite helpful* or *Very helpful* in helping them learn the material for their STEM class. Only 7% of responding students indicated the Fellows were *Not helpful* in this respect. This same pattern was also true when students were asked about how the Fellows' presence impacted their confidence in learning STEM. On this question, 62% of responding students indicated their confidence had increased because of the Fellow, while only three students (1.8%) said their confidence had *decreased*.

The final two questions on the high school survey asked students to rate the degree to which their interest in their specific class and in STEM had changed as a result of the GK-12 Fellow working with their teacher. Over half of all responding students (53%) felt they liked

their class more because of the Fellow, 26% already liked the class a lot, and 14% never liked the class. Only 6% of responding students suggested they liked the class *Less* because of the GK-12 Fellow. When asked to comment on how the Fellow had impacted their interest in STEM in general, most students (76%) were more interested in STEM because of the Fellow. This includes 27% of responding students who indicated they were *always interested in getting more STEM.*

In sum, students – whether middle or high school – were positive about the presence of the GK-12 Fellows in their classes. They indicated these graduate students had increased their knowledge in their classes, increased their interest in their classes, and made them more likely to study STEM in the future.

Section 15: High School Student Responses Post-program Survey

GK-12 Sensors! High School Student Survey Summary of Results, May 2006

		Count	Column N %
Which year of high school are you in now?	First Year	114	51.4%
	Sophomore Year	35	15.8%
	Junior Year	38	17.1%
	Senior Year	21	9.5%
	Other	1	.5%
	Not selected	13	5.9%
How far do you think you will go in school?	Probably won't finish high school	1	.5%
	High school diploma	8	3.9%
	Trade or vocational school	6	2.9%
	Some college, but no degree	4	1.9%
	Get a 2-year (associate's) degree	13	6.3%
	Get a 4-year (bachelor's) degree	83	40.1%
	Master degree, Ph.D. degree, professional degree, or other advanced degree	74	35.7%
	Other	3	1.4%
	Do not know	15	7.2%
	Not selected	0	.0%
If you go on to any kind of training, school, or college after high school, what do you plan to study?	Mostly subjects in the mathematics and/or science area	103	46.4%
	Some mathematics and/or science, but it will not be the major area	78	35.1%
	As little mathematics or science as I can	37	16.7%
	Not selected	4	1.8%
How well do you generally do in mathematics and science courses?	Very well	70	31.7%
	Reasonably well	138	62.4%
	Not very well	6	2.7%
	Not well at all	4	1.8%
	Varies a lot	3	1.4%
	Not selected	0	.0%
In general, do you like mathematics and science courses?	They are usually my favorites	91	41.2%
	They are OK, not usually my favorites	101	45.7%
	Do not usually like them	25	11.3%
	Never like them	4	1.8%
	Not select	0	.0%
How useful was having these university students in this class in helping you learn the subject	Very helpful	79	35.6%
	Somewhat helpful	110	49.5%

you were taking?	Not helpful	9	4.1%
	Do not know	24	10.8%
	Not selected	0	.0%
Do you think having these University students working in your class will change your confidence about doing the subject you were taking?	I always had a lot of confidence in my ability in this area, and it won't change	48	21.6%
	I will be a lot more confident	39	17.6%
	I will be a little more confident	120	54.1%
	I will be a little less confident	4	1.8%
	I will be a lot less confident	2	.9%
	I never had much confidence in this area, and it won't change	8	3.6%
	Not selected	1	.5%
Did having these University students working in your class change how much you liked or don't like the subject in this class?	I always liked this subject a lot, and it won't change	59	26.6%
	I will like it a lot more because of the University students	33	14.9%
	I will like it a little more	110	49.5%
	I will like it a little less	2	.9%
	I will like it a lot less	0	.0%
	I never liked it much, and it won't change	16	7.2%
	Not selected	2	.9%
Will having the University students in your class change your interest in getting more education in science, technology, and mathematics subjects after high school?	I was always interested in getting more science, technology, and mathematics, and it won't change	63	28.4%
	I will be a lot more interested because of the University student	31	14.0%
	I will be a little more interested	95	42.8%
	I will be a little less interested	8	3.6%
	I will be a lot less interested	3	1.4%
	I never was interested, and it won't change	20	9.0%
	Not selected	2	.9%
Have you filled out this same questionnaire in another class this semester?	Yes	5	2.3%
	No	216	97.3%
	Not selected	1	.5%

Section 16: Middle School Students Responses to Post Program Survey

		Count	Column N %
Which year of school are you in now?	5th grade	1	1.0%
	6th grade	2	2.0%
	7th grade	61	61.0%
	8th grade	34	34.0%
	Other	2	2.0%
	Not selected	0	.0%
How far do you think you will go in school?	Probably won't finish high school	0	.0%
	High school diploma	4	3.7%
	Trade or Vocational School	0	.0%
	Some college, but no degree	0	.0%
	Get a 2-year (associate's) degree	11	10.2%
	Get a 4-year (bachelor's) degree	41	38.0%
	Master's degree, Ph.D. degree, professional degree, or other advanced degree	40	37.0%
	Other	3	2.8%
	Don't know	9	8.3%
	Not selected	0	.0%
If you go on to any kind of training, school, or college after high school, what do you plan to study?	Mostly subjects in the mathematics and/or science area	38	35.2%
	Some mathematics and/or science, but it won't be the major area	49	45.4%
	As little mathematics or science as I can	21	19.4%
	Not selected	0	.0%
How well do you generally do in mathematics and science courses?	Very well	36	33.3%
	Reasonably well	62	57.4%
	Not very well	6	5.6%
	Not well at all	2	1.9%
	Varies a lot	2	1.9%
	Not selected	0	.0%
In general, do you like mathematics and science courses?	They're usually my favorites	41	38.0%
	They're OK, not usually my favorites	53	49.1%
	Don't usually like them	9	8.3%
	Never like them	5	4.6%
	Not selected	0	.0%
How useful do you think having	Very helpful	56	51.4%

these university students in this class will be in helping you learn the subject you are taking?	Somewhat helpful	44	40.4%
	Not helpful	5	4.6%
	Don't know	4	3.7%
	Not selected	0	.0%
Do you think having these University students in your class will change your confidence about doing the subject you were taking?	I always had a lot of confidence in my ability in this area, and it won't change.	34	31.5%
	I will be a lot more confident	18	16.7%
	I will be a little more confident	48	44.4%
	I will be a little less confident	0	.0%
	I will be a lot less confident	2	1.9%
	I never had much confidence in this area, and it won't change	6	5.6%
	Not selected	0	.0%
Will having these University students working in your class change how much you like or don't like the subject in this class?	I always liked this subject a lot, and it won't change	29	26.9%
	I will like it a lot more because of the University students	30	27.8%
	I will like it a little more	37	34.3%
	I will like it a little less	2	1.9%
	I will like it a lot less	2	1.9%
	I never liked it much, and it won't change	8	7.4%
	Not selected	0	.0%
Will having the University students in your class change your interest in getting more education in science, technology, and mathematics subjects after high school?	I was always interested in getting more science, technology, and mathematics, and it won't change	30	27.8%
	I will be a lot more interested because of the University students	17	15.7%
	I will be a little more interested	44	40.7%
	I will be less interested	3	2.8%
	I will be a lot less interested	1	.9%
	I never was interested, and it won't change	13	12.0%
	Not selected	0	.0%
Have you filled out this same questionnaire in another class this semester?	Yes	24	22.2%
	No	84	77.8%
	Not selected	0	.0%

Section 17 High School Students Responses to Post-program Survey

		Count	Column N %
Which year of school are you in now?	9th grade	1	1.3%
	10th grade	14	17.7%
	11th grade	47	59.5%
	12th grade	17	21.5%
	Other	0	.0%
	Not selected	0	.0%
How far do you think you will go in school?	Probably won't finish high school	0	.0%
	High school diploma	4	4.3%
	Trade or Vocational School	2	2.2%
	Some college, but no degree	2	2.2%
	Get a 2-year (associate's) degree	14	15.2%
	Get a 4-year (bachelor's) degree	35	38.0%
	Master's degree, Ph.D. degree, professional degree, or other advanced degree	22	23.9%
	Other	4	4.3%
	Don't know	9	9.8%
	Not selected	0	.0%
If you go on to any kind of training, school, or college after high school, what do you plan to study?	Mostly subjects in the mathematics and/or science area	27	30.3%
	Some mathematics and/or science, but it won't be the major area	31	34.8%
	As little mathematics or science as I can	31	34.8%
	Not selected	0	.0%
How well do you generally do in mathematics and science courses?	Very well	10	10.8%
	Reasonably well	60	64.5%
	Not very well	17	18.3%
	Not well at all	3	3.2%
	Varies a lot	3	3.2%
	Not selected	0	.0%
In general, do you like mathematics and science courses?	They're usually my favorites	24	25.8%
	They're OK, not usually my favorites	48	51.6%
	Don't usually like them	14	15.1%
	Never like them	7	7.5%
	Not selected	0	.0%
How useful do you think having these university students in this class will be in helping you	Very helpful	27	29.0%
	Somewhat helpful	45	48.4%

learn the subject you are taking?	Not helpful	12	12.9%
	Don't know	9	9.7%
	Not selected	0	.0%
Do you think having these University students in your class will change your confidence about doing the subject you were taking?	I always had a lot of confidence in my ability in this area, and it won't change.	13	14.0%
	I will be a lot more confident	14	15.1%
	I will be a little more confident	48	51.6%
	I will be a little less confident	4	4.3%
	I will be a lot less confident	4	4.3%
	I never had much confidence in this area, and it won't change	10	10.8%
	Not selected	0	.0%
Will having these University students working in your class change how much you like or don't like the subject in this class?	I always liked this subject a lot, and it won't change	10	10.9%
	I will like it a lot more because of the University students	12	13.0%
	I will like it a little more	44	47.8%
	I will like it a little less	9	9.8%
	I will like it a lot less	1	1.1%
	I never liked it much, and it won't change	16	17.4%
	Not selected	0	.0%
Will having the University students in your class change your interest in getting more education in science, technology, and mathematics subjects after high school?	I was always interested in getting more science, technology, and mathematics, and it won't change	14	15.2%
	I will be a lot more interested because of the University students	15	16.3%
	I will be a little more interested	39	42.4%
	I will be less interested	10	10.9%
	I will be a lot less interested	2	2.2%
	I never was interested, and it won't change	12	13.0%
	Not selected	0	.0%
Have you filled out this same questionnaire in another class this semester?	Yes	31	33.7%
	No	61	66.3%
	Not selected	0	.0%

Section 18: Student Focus Group

Group 1
We're meeting today to talk about the graduate students at the University of Maine who came into your class, helped you with, in this case GIS, talk about the kinds of things that person did with your class this year, what you thought about it, also talk about what your plans are after high school if you've got any, and you don't have to participate today but it would be really helpful and your participation would help those folks who send the University students out to the schools. Do you guys agree to participate?
Yeah.

Alright. So the fellow, she's been coming in since February, and you're in human geography.

No, GIS.

This is the GIS class ok, what did you think the purpose was of having this person come in to work with your class.

To help out in the class and to get us more interested and show some new tools about it and stuff that we don't know and Mrs. Chernosky may not know about it.

Tell me more about that, what have you done different or new or that you've learned?

She's shown us how to do densities in the class and the spatial analyst tools she knows mostly about, the art catalogue that's part of the program.

She knows a lot more than Mrs. Chernosky knows about this program cause Mrs. Chernosky did the other program she knows the 3.3 which is the earlier version of the program.

So what does she do when she comes in?

She helps people out with projects.

She usually has an explanation of what we're going to do today and if we're going to do ?? densities or if we have to buffer any areas with the crime unit we're doing right now.

Ok, did she introduce anything new that you guys weren't doing before?
Densities

Anything else? What's the point of doing that stuff, Densities, buffers and so forth?

It makes it easier to analyze the data.

So what would you do with the data?
You can tell where there's more crime/less crime and you can compare it to other things like land use.

It won't be so confusing, instead of just using dots to show where each crime happened…

Which don't work because there can be more than one point in the same place.

It shows a range of the area of the density of how condensed the crime is in one area. If it's just downtown Bangor or if it's out in rural areas.

What did you guys know about GIS before this year?

Not a lot.

Is it what you expected it to be?

Yeah, it's making maps, analyzing data but I can do more than I thought I would be able to do.

Yeah. Either of you thought about what you'd like to do when you're done with school?

College.

For what?

Computer science.

Math.

Right now I'm going to try and become a professional golfer.

Have you thought more about some of these tools or this discipline for going on in school?

No, not really.

I've thought about it before but it's just not something I'd like.

Ok, so were you guys already interested, you were talking about economics, but you were talking about scientific mathematically based field, was that your interest before this year?

Yeah.

How long has that been your interest?

Since I found out I was really good at math.

What is it that the graduate fellow when she comes in, what is it that's useful that she does?
She knows how to do things that we can't, and she helps learn how to do them.

Can you expound on that?

Looking at stuff like this for longer than we have and she knows how to analyze the data.

What's something that would be helpful if she did or she did differently that she's either not doing or not doing the way you wish it was happening now? What would be better, or what would make the experience better, her coming in?

It's harder for us to get our ideas to go into the map, because she knows ideas with hers just to make it even better. Our job was to map the Team centers and shelters in Bangor and she said to put a buffer on those crime around the shelters.

So did you have a better idea?

Our idea was to have the dots on there instead of the densities but that wasn't really more understanding of the data.

So what you're saying is that it would have been helpful for her to let you do it your way and then have you do it her way and then compare the difference even if your way wasn't right after all.

Yeah, but there's always a chance our idea was better.

That's good feedback, that's really specific. Anything else that would be good if it was different or either things that she should do differently or the way the whole thing is set or organized that could be different?

What do you think the impact on the class has been of having someone else come in, you've talked about her being able to help you but sometimes there's other things that happen that are either good or bad that aren't just about the work.

She puts more of a structured connection, everything we have to do, every step of the time, she's very informative, she writes the steps we have to go through to complete our program.

Is that good or bad?

That's good, because most of the stuff, there's some really complicated things in there that if they just say what they are we're just going to be lost, we'd have to ask her, but with this we can just go through every step at a time and click on our view open it, go to the add data, and just add the certain types of data in.

Sometimes though it's a little much because there's a bunch of different groups, sometimes her advice doesn't quite make sense for what we're doing but most of the time it's pretty good, and also, we get more complex stuff, but we move at a slower pace we've been doing the same project for quite a while.

A month.

Not a month, but a couple weeks.

What slows it down?

That we're going way more in depth than we were before.

What do you think about that?

Sometimes it just gets boring after awhile just doing the same project.

Also, a couple of times I thought we were done and then she comes up with something else to do, but for our group some of the files she gave us didn't work, so we couldn't do anything with them so we're kind of done already, but we're still expected to be working.

Well you're off the hook right now. That's good feedback, what else would you have to say, in general is this a good idea, this is just one example of one graduate student that goes out to work with kids.

She wants some of us to excel in that program and go further with it to college and she knows what she goes through college to do this so she gives us the right application to do this.

Well, unless you can think of something else, thank you very much.

Alright, that's all I need to know. They've been here since February and she's here twice a week right? Ok, what does she do when she comes into the class?

She comes into the class sometimes she'll instruct us kind of like Miss Chernosky does, if we're doing something new in the program, our GIS or we're starting a new subject, she'll briefly describe some new tools that we'll be using and she does it very well, she's focused for the most part, and once we get started on a project, she walks around the class, people have individual questions, she can answer them, help out. She doesn't necessarily assign homework, I believe that Mrs. Chernosky that does it but I believe she organizes notes for us pertaining certain tools in the program that we use and for the most part it's pretty easy to get a hold of how to do it. We're working on a crime unit and she's been the main leader with what instructions she wants us to do; she'll come over and show us examples of how to do a tool or something to improve your graph and your project you're working on and she gives instructions and tells us how we're doing as a whole group and how much she enjoys our company.

Is it worthwhile?

Yes.
I believe she has an understanding of the program, Mrs. Chernosky is not quite on that level yet, so yes it was definitely worth it. Beyond the technical piece of it, is there something that's beneficial about having second person or maybe confusing…

We have a decent sized class with a lot of computer stations and it's nice to have more than one person walking around helping us out with the program we're not entirely fluent in.

Also it's nice to have someone else's opinion besides Mrs. Chernosky because they're two different people, not everything's the same with them.

What about the rest of the class, would you say that your impression is similar to what your classmates would be if I were to ask them?

I'm pretty sure, I don't believe anyone has any problems with the Fellow, she's very helpful, very knowledgeable, she doesn't necessarily keep us on the leash, if we want to do something with the program we can kind of go off on our own, there aren't really any strict guidelines that we have to follow when we're doing a project or whatever.

Do both of you plan to go to college?

Yeah I am.

I'm going to the Navy.

What do you want to do when you go to college?

I'm going to be getting my bachelor's degree in science of broadcasting.

Going to the Navy specializing in what?

Not sure, Maybe GIS.
Yeah hopefully, that would be great.

Is this class what you thought it would be?

No, honestly when I signed up for the class, I was looking for something to get an extra credit and when I heard the term Geographic Information Systems I honestly had no idea what to expect, I knew it had something to do with the computer, I wasn't even sure we'd be using a particular program I had no idea, so to answer your question, yeah it definitely wasn't what I expected at all.

I didn't know anything about GIS and I didn't know anything about ?? or anything, but it's amazing, it's really cool.

So this crime unit that you're doing, have you done anything with that that you were surprised with, it was either interesting or boring?
What's interesting to me is the level of information that's available on a public scale, I think that's very interesting, I honestly wasn't expecting to acquire that much data that you can use and put into the program, I think that's probably the most surprising aspect for me at least.

There's a lot that is also unknown and there's so much you can do, it's amazing.

How?

Amazing, there's just so much you can do and there's so much more that you can get, densities, you can acquire much on how you want to present something, like the way you present it can be different depending on what tools you use.

You're going into broadcasting, do you see yourself ever pursuing either a minor area in the sciences or the maths or do you?

Yes, I do.

Science and maths, pursuing some kind of job that doesn't, honestly I've never been inclined to go towards science or the math fields, I'm broadcasting, writing, communications, that's really my gig, if you know what I mean.

I do, after you said about three words I would have guessed that.

So that's definitely the direction I want to go in.

What in particular in the science and math fields would you be interested in?

Anything, I haven't really narrowed my thoughts down.

Is your thought to go to school after the Navy?

Yes.

Great. What's something that could be done better, you've told me about some things that have gone well, some things that….what could be done better in the class, what could be done better with this person coming in, what would improve it?

More lessons, more this is the deadline that this has to be done, we don't really get that often, because it's a brand new class we don't really have much to go by but I think more deadlines would be good so we could learn more and do more.

Would you concur?

I would concur. My concern for the most part regards the program. It's very hard to get a grasp of some of the things that go on in the program. Arc GIS is what I'm speaking of…

Unfortunately I know first hand.
Yeah it's very hard to go off on your own in the class without help from the instructor and I wish there was some sort of tutorial that was perhaps included with each station that if you wanted to do a particular thing you could type in, you know how they have those cue types, but for the

most part those are non existent with the computers no kind of tutorials for the most part, so if you want help you either need to do guess and check or you need to get help from an instructor and since there are only 2 instructors in the class that's not always an option when you're trying to get something done on time.

Is the whole thing worthwhile to do?

The class?

The class itself.

I think it's been very knowledgeable, it's easy as long as you pay attention and do work, really there's not a lot of homework that goes along with the class, which is a plus.

There can't be right?

Yeah, really, it's a great class all around and I would recommend it to just about anyone in the school.

Is it worthwhile to have these graduate students knowing that the fellow that is in your classroom is only one of eleven and they go out and work and there's another fellow here, he's teaching some math and computer programming classes, is this a worthwhile thing to do?

As far as sending people out?

Yeah.

Yeah it really does, because I seriously believe that the people you send to these classes just from experiencing the Fellow, I believe they're getting a grasp on how to actually teach people to use the program, you can know how to use something, but I believe when she and these people are getting hands on with people who don't know the program, over time they'll eventually learn to explain it in a way that's a lot easier and you can remember it.

Is she getting better at doing this?

Oh yeah, since the moment she first came in to now, honestly, I've seen progression.

Good.

And even when she came in she was very good for the most part.

Good. What about you, what do you think?
There so much more you can learn from one person, and there's so much more you can teach one person, so I think it's helpful to have somebody else with a different perspective come in.

What I'd like to do is talk with you today about your experience in the GIS class

Ok, so the Fellow, what did she do when she came into the class?

When she first came in?

Yeah.

She first came in, introduced herself, explained what the GK12 program was, and how she was up at UMaine and how she was going to come in and she was going to participate and help us with using the GIS program every week and it was also part of the classes she was taking, which was part of the reason she was here. She has introduced a lot of different ideas and approaches to different things as far as GIS goes, especially answering different types of questions, because originally when we first started doing this she hadn't come yet, we were really focusing on really extrapolating the different questions we were asking about the maps we were making. We were just basically going, ok we need to make theses maps, but once we made them, we weren't really asking any questions about what the data gave us after. So after she came, we started looking a lot more at ok now that we have this data and we have all these different fields and we can see that these points are here and they're in this field here, what does that mean, and how does that relate to all of the crimes or different things like that. We're doing a lot more things like that then we were originally, now that she's here…

You've done a couple of different projects, which so far has been your favorite?

My favorite would be the first one we did, or the one after she came, we mapped or me and my partner mapped every single student that goes to Bangor High and where they lived so as to show people you can show people and determine what the bus routes are and things like that. Every single student for every single grade in Bangor inside the physical area of Bangor we mapped, and outside of Bangor, so we used different maps. So you can tell, it's amazing how far some students travel here, they travel for like 45 minutes to an hour, some kids to get here, and we had no idea really that they lived that far out, and there's a huge clump of kids in Bangor, but then you go outside of Bangor and there's one kid in Brewer and two up in Old Town, and even though they have their own high schools they still come here. There are actually, you don't think about that you think oh everyone goes from Bangor but that's not true. There are some people that go an hour away from here.

So did you make any recommendations based on that map?

Yeah we made just a few, we thought that school should provide maybe starting just a little bit later than it does, maybe 15 to 20 minutes later than it does now, so as to provide a little bit of extra time for students who live an hour away to get here, because I personally know a couple of my friends who come here, they have a really hard time making it here on time right when the bell rings. That's one thing we were able to determine.
School starts here at 8 right?

At 8, yeah, but even if it's an hour before, that means you have to get up at about 5:30 because you still have to get up, get dressed, and everything like that.

Which of the lessons or the things that you've done haven't been as good?

What haven't been as helpful?

Yeah. I'm talking about the lessons part, I'm going to ask some other questions, how she's working with the class, what's good about that and what's not but right now on the content, what you've actually been doing are there any of the parts that you've done that you've thought, eh this isn't really worthwhile?

There have been some times when I thought where we are right now, even though we are taking things to the next level, sometimes I've thought, well I didn't really know how to do this because I know another way how to get that. Geo databases and things like that I know how to a lot of stuff without using them and I realized they're easy to use once you get into using them but they're really hard to get into, so there are certain aspects of things where you can use some things, you can do it two ways, I often find I like doing things a lot of different ways, to get the same job done. It's just a lot harder to curb what you've originally learned how to do and go do other things so I kind of view that as not quite as worthwhile, I realize it is but when you already know how to do it, you really don't want to push off to the right and make the river turn.

Ok, what about the rest of the class, you can't really speak for them but in your observation, what do you think?

I know everybody really enjoys the class, we all like it a lot, it's a very good class, we all realize that there aren't very many of them even in the nation, as far as GIS classes go in high school, and it's kind of like the first of its kind and we're blazing a new trail, and we really like it; we're even developing some of our own lesson plans, we did that earlier, like my group did geo coding; we all sat down and we taught how to do, we made power points and presentations after spending three or four weeks figuring out down pat how to do our specific task and then we presented it to the class on how to do these step by step and we actually made lesson plans for next year if Mrs. Chernosky wants to use them, and things like that, and they're really helpful, they're really good, and it really taught us how to use the program to its best and we spent about a day on each one after we gave our presentation on showing people how to use these things, we'd actually sit down at our computers and we'd all try to do it out, if we had any questions we'd ask each other, it really made us more proficient in doing it.

Do you plan to go to college?

Yes, I do, I'm either going to go to Eastern Maine Community College or the University of Maine. If I go to EMCC, I'm going to go there for a year or two years and then go to Maine, so either way I'm going to head up to Maine.

Good, did the Fellow make you think about what you could do at college?

Yeah she did actually, she actually got me in touch with a whole bunch of the people up to UMaine and just to talk to them, she actually arranged for me to go up there on a tour of the

engineering department, which I hadn't had a chance to do, and it was really exciting, I got to go up there with Mrs. Chernosky and her and I got a tour of the facility and it really made me think about the kinds of things that I want to be doing and now after I've taken this class and I've gone up there, and I've seen a lot of things, I really know that I want to go into some type of engineering field, and I want to go up to UMaine, whereas before I didn't really know what I wanted to do, I was thinking of going to EMCC and then maybe heading out of state to go to Florida or something for some type of graphics degree, but now I'm really certain that I want to go to UMaine, I want to get some type of engineering degree, so I'm really excited about it, and that's somehow or other, I'm going to get up there and I'm not going to go into electrical engineering but if I go to a community college here, I'm going to go into some type of architectural design for two years, get a degree in architecture, associates degree in architecture, then I'm going to go to UMaine and I'm going to go into a basic engineering program for two years.

That sounds good.

What's one thing that the fellow does really well?

That she does really well? She interacts with us all really well, whenever we have an issue we can go to her and we're like oh what's this problem and she actually comes over and she sits down with each of us, she might not get to everyone in one day but whenever we have a real issue she comes over and she helps us until we actually figure it out. She goes through every step to figure out what the issue is and we sit down and we don't have any problems with talking to her if we have an issue we can go to her, we don't feel bad about asking because she's an easy person to talk to, you can sit down with her, she'll go through whatever problem you have, and once you have it done she'll move on to the next person, but she doesn't get up and leave and move around, or do anything, she focuses on you when you have an issue and then she moves to the next person. I think that's really helpful, so that way you're never left hanging, you always get each individual thing that you need done and if you really have an issue she'll come help you with it.

Ok, what's one thing that she should do differently or better?

Have more time, make the classes longer, (that's not doable), sometimes in her presentations, just be a little more in depth in some aspects of the things she's showing, maybe provide some more handouts.

Is there anything else that you would comment on?

She's been really really great to the class, and it's been really good that she's been here, especially on the first year of this class starting out, because just having Mrs. Chernosky coming around, although she's good with the program, it's better to have extra people coming in to help and making sure everything is runs right and it's been a really good thing because if it had just been Miss Chernosky I'm not sure this class would have gone quite as far as it has this year.

Great. That's it. Thank you very much.

Group 2

The reason I had you come in today that I'm actually hired by the program that the GK-12 fellow works for, that pays him his stipend to go to school and to come here and do what he does. To talk to some of you guys about the work that he's been doing in the class this year, and what that's been like. So, I have this little thing that I've got to read…

Alright so you had this Fellow just for the computer science course?

Yes.

Have any of you had another GK12 fellow in any other science class you've ever had?

What do you think the purpose of having the graduate student come in?

To teach us about circuits and more advanced programming then what we were doing.
It seems like he came to teach us stuff that our regular teacher wouldn't teach us or get to.

Ok.

It also seemed like it was an opportunity for him to get experience in teaching other people.

Yeah, so any other comments on that? What does he usually do when he comes in? I've watched him a couple of times but…

He normally starts if it's something new, he'll go over it using power point, or something like that and then he'll explain what he wants us all to do, he'll explain how it all goes and then he'll have us try it, be it circuitry or the open graphic library program that we were doing earlier in the year. He always makes sure everyone understands it as much as they can before letting us go and he'll do his best to answer any questions while we're working on what he wants us to work on.

Any other comments about that?

Well, I found a lot of it kind of confusing, maybe he just doesn't get that for at least the majority of the class that this is pretty much our first time working with any of these programs. So, he takes for granted that we know something even if we don't know and it's hard to ask questions about things.
Some of the things that he did are very hard and mostly confusing but most of the time I got it, especially in the early year, I got a lot of the binary numbers, the different numbers, but now it's kind of confusing for me.

He'd bring a new section, something that he can do with us, but he would teach us what it does, but we hadn't really learned how to make it, how to make a program.

He would explain how to do what he wanted us to do without explaining how the underlying building blocks built what he wanted us to do, so it's like getting the answer to something without getting the equation, it's a punch line without a joke, he didn't explain the underlying equation beforehand, so we couldn't base anything else off of it.

He must have done a bunch of different things this year right?

He did two main things.

Two main things, which has been your favorite thing that he's done?

Circuitry.

Circuitry, the thing you're doing right now.

Yes.

Well we'll get back to it. What has been your least favorite?

Open GL.

It wasn't the fact that he wasn't trying to explain it, because he was but the fact that we would have him on Tuesday and then only Tuesdays and Thursdays, everything we'd learned on Tuesday we'd have to spend half the class re-teaching it to us on Thursday, so we'd just be getting a little bit ahead each time.

Also it was kind of boring, just the idea of open GL being so complicated, in C++ what we did the first time, we'd start with this basic program that we just count a couple of numbers and we'd go through and see ok this is how each things works, but with open GL there's just so much that you need to put in to do the simplest thing, it was hard just to comprehend what everyone was doing.

It would also be easier if instead of coming in on Tuesdays and Thursday, he could come on Monday, Tuesday and maybe Wednesday or just Monday and Tuesday, two days side by side so then we won't forget the next day.

So is what he does, the graduate student, is what he does completely different from what you do the rest of the time?

It's really different.

Programming that was C++, this is more graphic, we kind of went as far with C++ as possible, so it was nice to do something else, he says no, but…as far as this course is going to take, it's kind of an open class so it's kind of neat to explore something new, he went right into it so that

was maybe a little much for our class but it was nice to see something different, kind of get our feet wet in the rest of the computer programs.

None of us are really getting to our projects because we have another project with Mr. ?? that probably won't get completed either with this time, because between all three different subjects at once we can't do it.

Ok, do you think that the rest of the class would say about the same thing as what you guys are saying, are you all in agreement?

Yeah.

Is it worthwhile to have him come in?

Yes.

Why?

Because as we were saying it's really great to be introduced to such new things and especially the circuitry; you take the programming class and that's great as far as the software goes, but for me anyway it's really interesting to start getting into the very basics, I mean I know we're not even scratching the surface but the very basics of how the hardware that runs our software works as well, so it's kind of neat to see how the other sides of things works besides the computer. And even if we don't really understand it, it's nice to just get a brief introduction of a couple of these programs that maybe in a couple years we can…

It helps us decide what we want to do, if this is something we might want to do for the rest of our lives.

My major is going to be computer science so this is probably going to come in really handy because I can almost guarantee I'm going to have to do something along these lines in some class later on, so it's going to be a huge help because he was so patient explaining the stuff that I now have the basics I probably wouldn't get in a college class.

Same with me, I'm also going to be doing a computer related job.

Well that's actually a perfect introduction into the next piece here, which is what are your plans after school, if you know, you said computer science…

University of Maine at Farmington for a computer science major, and then I don't know if I'll go for any other degrees past that, but that's what I'm doing now, I've already been accepted and all that stuff.

Great. You haven't thought about going to Maine huh?

Orono? I thought about it, but it was too close, and their description of their computer program wasn't what I was hoping for.

That's good feedback.

Who said hardware?

What did you mean by that?

I'm in the Air Force right now, and my job is assistant, and my premier job is to design robots and make sure they work, strong to safely destroy weapons and I would like to do it manually but the point is to make the robots do it, so less lives on hand to do detonations…

Cool, what about you other guys?

I'm already accepted and I'm going to go to UMaine for mechanical engineering and I already have a job there on campus.

Where?

At the AWC center. This course was, I just needed a class, it seemed interesting so…

That's great.

I'm going into archaeology, in Canada.

That's great.

I figured this class would be important because I see in 20 years computers are going to be running everything, so I better know how to work a computer.

Now did you take the GIS class also?

No, I didn't know we had it at that point, or else I would have taken that instead, because it would have come in more handy.

Yeah, for archaeology, all of that stuff. So I know you're only in your first year here, but do you have thoughts yet about what you want to do?

I was actually planning on computer science or computer engineering major, I haven't really thought about different schools yet.

Ok, just a couple of final questions, what's one thing that the fellow does really well?

He's patient, for me anyway, because quite obviously I can't see the power points and all that stuff, so every time he came up with a new power point, if not that day, then the next time he

came in he'd have a text version of it so that I could follow along, he'd always make sure I had an accessible version of whatever he was doing. Every time I don't get something even though he probably wants to choke me, he'll stand there for 15-20 minutes explaining what's going on even after the bell has rung, so I've been late to my next class a few times, but he's extremely patient and he never gets short with it, he always does his best to make sure everyone knows what's going on.

He is also very diligent, in the fact that no matter what, if you have a question and he doesn't know it, the next day you see him or he sees you, he will tell you what that is no matter what. It seems like he puts our class pretty high up on his priority list.

On the open GL he actually made this website for us, so if we had any questions on the website we could just email him, and he'd post his result up right away, basically the next day it would be there, even if he wasn't going to be there we'd still have our answer.

What's one thing that he should do better?

Basics, with the open GL I would be looking at the code, and we wouldn't understand what the code even said, I would start with just the code and he would say this is all this and try to explain the basics and start with very simple programs.

Especially in this class we had so many sophomores and freshmen that some of what he's doing would be really good for maybe a higher level class than for this class which is more introductory.

I wish he would stay on one topic and finish it, like the open GL, they were pretty much open in the air and he started a whole new thing in circuitry, and I wish that he had ended it…
Try and bring it together…

End.

Section 19: Fall & Spring Classroom Observations

This section contains a summary of results from the fall and spring observations of GK-12 Fellows. The need for these observations came from anecdotal comments by Fellows and cooperating teachers indicating considerable variation in program implementation across the schools. The need was further underscored by the NSF annual conference of GK-12 grantees. At that conference, GK-12 programs were strongly encouraged to incorporate direct classroom observation as one component of their evaluation strategy.

For the UMaine GK-12 classroom observations, two systematic observation techniques were employed. First, each Fellow was observed using an observation protocol developed by Horizon Research for NSF to evaluate highly effective science instruction. The second tool used was a time sample analysis. Complete descriptions of these processes appear in later sections of this report.

Section I: Summary of Findings from the NSF Observation Protocol:

For this preliminary meeting, each table is presented in the same order that the questions appear on the original protocol. Note that the question stem is referenced in the table, but in most cases, not the entire question. The reader will find it handy to separate Appendix A from the report and use it as a guide when looking at these tables. The comments and qualitative responses appear at the end of the tables, so the reader will notice some items are missing. These are discussed after the presentation of the tables.

Gender Makeup of Classes:

One interesting note is that most of the advanced classes were primarily made up of females. General science classes tended to be more evenly split. One example is an honors Biology course: 83% Female, 17% Male. Another is Honors Calculus 67% Female, 33% Male. Finally, one basic general Science course had 50% Females and 50% Males. Across all of the placements, even those including general classes, more girls than boys were enrolled in science courses with the GK-12 Fellows.

Table 1

	Percent
Percent Female	.58
Percent Male	.42

Instructional Focus of the Lesson:

Table 2 shows the overall focus of the Fellows' lessons. Most of the time, Fellows focused on the broad concepts in Science, with little focus on teaching specific skills. Still, a substantial amount of Fellows' time was spent teaching facts, vocabulary and algorithms. These tended to manifest themselves as worksheet activities, or other basic direct learning activities. For these lessons, there was no experiment or demonstration and usually no lab/inquiry experience. There seemed to be some movement towards concepts in the spring 2007 observations as depicted in Table 2 below.

Table 2

		Fall	**Spring**
Based on time spent, the focus of this lesson is best described as:	Almost entirely working on the development of algorithms/facts/vocabulary	18.2%	**10.0%**
	Mostly working on the development of algorithms/facts/vocabulary, but working on some mathematics/science	9.1%	**0.0%**
	About equally working on algorithms/facts/vocabulary and working on mathematics/science concepts	9.1%	**20.0%**
	Mostly working on mathematics/science concepts, but working on some algorithms/facts/vocabulary	9.1%	**20.0%**
	Almost entirely working on mathematics/science concepts	54.5%	**50.0%**

Content Focus of the Lesson:

In Table 3, the classrooms were rated on several characteristics of the lesson including: organization, content, active learning, alignment to goals, "sensemaking", and wrap-up. There are several possible trends that warrant attention. First, the apparent amount of preparation was not consistently high. In fact, using the descriptors in the NSF protocol as a guide, only 2 of the 11 observations reached this standard. In some cases, materials were not ready; in others the Fellow was not prepared to talk about the topic or was unsure of what the next step in the activity was.

Another area of concern was the degree of connectedness with prior learning. In many cases, Fellows began a lesson with no link to students' prior knowledge. For one lesson, the Fellow asked the students: "so you have covered this before, right?" The Fellow didn't wait to find out the answer. Instead, the next phrase was "excellent, so given what you know about X, you can see how it applies to the solution to this problem." This was a typical pattern for those lessons where Fellows failed to make an adequate link to students' existing knowledge and experience.

A final area of concern is the amount of time Fellows dedicate to summary and wrap up activities. NSF refers to these as "sensemaking" activities. Perhaps not surprisingly, Fellows planned too much material for too little time. The result in several lessons was no time remaining to discuss the importance, or even what happened in an experiment. In fact, there were only two lessons where the Fellow conducted an inquiry based lab activity *and* left enough time to process what happened with the students afterwards. For a regular classroom teacher this processing can happen the next day. Because most Fellows are in the classroom sporadically, it is much more important for them to bring closure and meaning their activities the day they do them. Unlike the content focus, this area did not improve significantly from the fall to the spring.

This is not to say that there were not positive indicators in the observed Lessons. On the contrary, Fellows did a solid job of using resources, creating an open learning environment and working collaboratively with students. In fact, Fellows really shined at working directly with the students in a respectful, inviting manner. Almost all of the Fellows had a comfortable, friendly and engaging style that promoted their connections to the students.

The synthesis rating of 2.91 in the fall and 3.08 in the spring reflects this mixed performance. The work of the Fellows was mixed in delivering science education using the best practices as defined by this protocol. Addressing the concerns mentioned above would substantially improve design of these lessons. Unless the Fellows systematically plan to incorporate best practices in science education, they are not likely to deliver them during instruction.

Table 3

	Not at all		Little		Somewhat		Mostly		To a great extent		Not Observed	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
The mathematics/science content was significant and worthwhile.	9.1%	20.0%	18.2%	20.0%	36.4%	40.0%	36.4%	10.0%	.0%	10.0%	.0%	.0%
The mathematics/science content was appropriate for	9.1%	20.0%	9.1%	10.0%	9.1%	20.0%	54.5%	50.0%	18.2%	.0%	.0%	.0%
Teacher-provided content information was accurate.	.0%	.0%	.0%	.0%	9.1%	0.0%	45.5%	50.0%	45.5%	50.0%	.0%	.0%
Students were intellectually engaged with important ideas	18.2%	30.0%	9.1%	20.0%	27.3%	30.0%	45.5%	20.0%	.0%	.0%	.0%	.0%
The teacher displayed an understanding of mathematics/science	.0%	.0%	9.1%	.0%	.0%	.0%	63.6%	40.0%	27.3%	60.0%	.0%	.0%
Mathematics/science was portrayed as a dynamic body	.0%	.0%	18.2%	10.0%	54.5%	40.0%	27.3%	40.0%	.0%	10.0%	.0%	.0%
Elements of mathematical/science abstraction (e.g., symbolic	18.2%	10.0%	18.2%	30.0%	36.4%	30.0%	9.1%	20.0%	18.2%	10.0%	.0%	.0%
Appropriate connections were made to other areas of mathematics/	9.1%	10.0%	27.3%	20.0%	18.2%	20.0%	36.4%	40.0%	.0%	10.0%	.0%	.0%
The degree of "sense-making" of mathematics/science content	27.3%	.0%	.0%	.0%	9.1%	.0%	36.4%	.0%	27.3%	.0%	.0%	.0%

Table 4

	Mean Fall	Mean Spring
Synthesis rating area 1	2.91	3.08

Instruction and Delivery:

Table 5 shows the performance of the Fellows on the next indicator: Implementation. Implementation refers to the ways that the Fellows delivered their instruction including teacher confidence, verbal interaction, questioning strategies and classroom management. Taken together, these are the qualities that make a teacher effective "in the moment" of teaching. The results for the GK-12 Fellows in this area were mixed. Some of the Fellows had an effective delivery of the lesson, used appropriate questioning techniques, checked for student understanding and proceeded at a pace that worked for the students. Other Fellows did not have these skills. An examination of the raw data supports this conclusion also – those Fellows with high rankings in one area have high rankings in all areas. Conversely, Fellows who scored low tended to score low in all areas. This variation in instructional delivery is expected for a one-time observation. Still, as an experienced observer of teachers and classrooms, the discrepancies between the best teaching observed and the worst cannot be explained solely due to random

differences on the day of the observation. Clearly, there are real differences in the Fellows' teaching skills.

Table 5

	Not at all		Little		Somewhat		Mostly		To a great extent		Not Observed	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
The instructional strategies were consistent with	9.1%	**.0%**	.0%	**20.0%**	27.3%	**10.0%**	45.5%	**60.0%**	18.2%	**10.0%**	.0%	**.0%**
The teacher appeared confident in his/her ability to teach	.0%	**0.0%**	.0%	**.0%**	27.3%	**20.0%**	54.5%	**50.0%**	18.2%	**30.0%**	.0%	**.0%**
The teacher's classroom management style/strategies	.0%	**0.0%**	27.3%	**20.0%**	.0%	**20.0%**	45.5%	**50.0%**	27.3%	**10.0%**	.0%	**.0%**
The pace of the lesson was appropriate for the developmental	.0%	**10.0%**	27.3%	**30.0%**	18.2%	**50.0%**	54.5%	**10.0%**	.0%	**.0%**	.0%	**.0%**
The teacher was able to "read" the students' level of understanding	9.1%	**20.0%**	9.1%	**20.0%**	27.3%	**40.0%**	45.5%	**10.0%**	9.1%	**10.0%**	.0%	**.0%**
The teacher's questioning strategies were likely to enhance the	18.2%	**20.0%**	9.1%	**20.0%**	18.2%	**10.0%**	54.5%	**40.0%**	.0%	**10.0%**	.0%	**.0%**

Table 6

	Mean	Standard Deviation
Synthesis rating	3.09	1.04

Quality Indicators for Math/Science:

The next area addressed on the systematic protocol was a set quality indicators for the Mathematics/Science content of the target lesson. The quality indicators included ratings of the appropriateness and worth of the lesson as well as the accuracy of the Fellow's instruction. This area also addressed the use of abstraction when teaching concepts, as well as the explicit links made to other disciplines and real world applications. Somewhat surprisingly, many Fellows did not adequately meet these goals during this set of observations. In some cases, lessons were not rated highly for scientific significance because those lessons were activities that were unconnected to theory. For example, when an activity is introduced that requires students to

build a bridge but there is little to no lead in for that activity in terms of design, shapes or characteristics of strong structures, it's difficult to imagine that students can spontaneously make those connections on their own. In some cases the Fellow had done a review on a previous day, but during the course of the activity, many opportunities to extend student learning were missed. This "missed opportunity" is reflected in the following scenario: (adapted from one fall 2006 observation.)

Students had completed building a bridge and then tried to test it. Upon testing it, the bridge failed. When the Fellow came over to the group to talk to them about what happened, the Fellow suggested: "why don't you try another design?" By itself, this is an appropriate response, but when taken in context of the whole lesson, the problem is clarified. The Fellow in this case was moving very quickly from group to group to check on progress. He spent a few seconds with each group before moving on the next. Questioning strategies were not used, and the students were not asked to reflect on why their bridge may have failed (or worked). At the end of the lesson, time ran out, and there was no discussion about why some groups structures failed and others succeeded. Compounding the problems in this lesson, the regular teacher was focusing on a different unit altogether. The bridge activity mentioned in this case happened right in the middle of a unit on cellular biology. Further attention will be paid to this issue later in this report.

Other areas on this portion of the observation showed similar variability across the Fellows' classes. Two areas of strength for the Fellows were the accuracy of their content and their displayed understanding of the material presented. While the observer is by no means an expert in Science, it is important to remember that the students in the class are not either. With regards to accuracy and comfort, most Fellows performed very well. When talking about their own areas of study, Fellows talked easily and comfortably. They also spoke with considerable authority on the topic, and were able to offer abstractions and elaboration easily and convincingly. The only issue was the consistency with which they did these things during this set of observations.

The synthesis rating of 2.9 (SD=1.2) in the fall and 3.08 (SD=.92) in the spring clearly shows the variability of the Fellows' performance in instruction.

Table 7

	Not at all		Little		Somewhat		Mostly		To a great extent		Not Observed	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
The mathematics/science content was significant and worthwhile.	9.1%	20.0%	18.2%	20.0%	36.4%	40.0%	36.4%	10.0%	.0%	10.0%	.0%	.0%
The mathematics/science content was appropriate for	9.1%	20.0%	9.1%	10.0%	9.1%	20.0%	54.5%	50.0%	18.2%	.0%	.0%	.0%
Teacher-provided content information was accurate.	.0%	.0%	.0%	.0%	9.1%	0.0%	45.5%	50.0%	45.5%	50.0%	.0%	.0%
Students were intellectually engaged with important ideas	18.2%	30.0%	9.1%	20.0%	27.3%	30.0%	45.5%	20.0%	.0%	.0%	.0%	.0%
The teacher displayed an understanding of mathematics/science	.0%	.0%	9.1%	.0%	.0%	.0%	63.6%	40.0%	27.3%	60.0%	.0%	.0%
Mathematics/science was portrayed as a dynamic body	.0%	.0%	18.2%	10.0%	54.5%	40.0%	27.3%	40.0%	.0%	10.0%	.0%	.0%
Elements of mathematical/science abstraction (e.g., symbolic	18.2%	10.0%	18.2%	30.0%	36.4%	30.0%	9.1%	20.0%	18.2%	10.0%	.0%	.0%
Appropriate connections were made to other areas of mathematics/	9.1%	10.0%	27.3%	20.0%	18.2%	20.0%	36.4%	40.0%	.0%	10.0%	.0%	.0%
The degree of "sense-making" of mathematics/science content	27.3%	.0%	.0%	.0%	9.1%	.0%	36.4%	.0%	27.3%	.0%	.0%	.0%

Table 8

	Mean	Standard Deviation
Synthesis rating	2.90	1.20

Classroom Culture:

The next portion of the NSF protocol evaluated the Classroom Culture of the observed lessons. This part of the observation protocol focused on characteristics such as participation, respect, cooperation and intellectual rigor. This is an area where the Fellows performed particularly well. Consistently, Fellows delivered lessons that gat the students directly involved in the learning. Only in a few cases were the students engaged in passive learning. The design of the lesson/activity was such that most students were directly involved in the learning process. This is something that rarely happens in teacher led activities. The overall ranking of 3.29 in the

fall and 3.46 in the spring for this area, coupled with a smaller standard deviation further demonstrates the high quality classroom culture promoted by the Fellows.

While this is an area of relative strength for the group as a whole, there were some exceptions. In one case, the Fellow did not recognize the extent of student off task behavior. During one portion of the activity, one student was putting on makeup, another was on the cell phone and a third was surfing the internet. These student behaviors distracted those students who were attempting to follow the lesson. When the Fellow recognized the behaviors there was no real response. In the observer's opinion, this has to do with a lack of experience working with students, and little practice with instruction. This is a theme that was repeated in many of the lessons observed, and manifested itself in a variety of ways. This topic will be addressed more fully in the recommendations section of this report.

Table 9

	Not at all		Little		Somewhat		Mostly		To a great extent		Not Observed	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Active participation of all was encouraged and valued.	.0%	.0%	27.3%	10.0%	.0%	.0%	54.5%	70.0%	18.2%	20.0%	.0%	.0%
There was a climate of respect for students' ideas,	.0%	.0%	.0%	.0%	9.1%	.0%	63.6%	60.0%	27.3%	40.0%	.0%	.0%
Interactions reflected collegial working relationships	.0%	.0%	.0%	.0%	9.1%	.0%	72.7%	50.0%	18.2%	50.0%	.0%	.0%
Interactions reflected collaborative working relationships	.0%	.0%	.0%	.0%	9.1%	.0%	63.6%	70.0%	27.3%	30.0%	.0%	.0%
The climate of the lesson encouraged students to generate	.0%	.0%	.0%	.0%	27.3%	20.0%	63.6%	50.0%	9.1%	30.0%	.0%	.0%
Intellectual rigor, constructive criticism, and the challenging	18.2%	10.0%	9.1%	10.0%	54.5%	40.0%	18.2%	30.0%	.0%	10.0%	.0%	.0%

Table 10

	Fall	Spring
Synthesis rating	3.27	3.46

Use of Instructional Time:

Table 11 shows the proportion of class time that was "on" and "off" task. This was generated by observing the number of minutes that classes were engaged in "lesson" activities, and the number of minutes wrapped up in non-instruction activities (announcements, attendance, equipment set up, etc.). Two things stand out with regards to instructional time. The first is how little instructional time is actually available to Fellows in the classroom. The second is the importance of careful planning to use that time wisely. The very large standard deviation demonstrates the large amount of variation in how Fellows used class time. In some cases, virtually no time at all was wasted in non-instructional time. For other lessons, a *majority* of the time was spent performing housekeeping, behavioral, set up or other non-instructional activities. Equipment problems were particularly troublesome in several observations. In one case, fully one-half of the instructional period was spent setting up and troubleshooting equipment. The result in this case were the behaviors mentioned above – cell phone usage and internet surfing. To be clear, this was *not* the normal pattern for the Fellows. Most lessons started right away, and most Fellows made good use of the instructional period. In general, the Fellows who made the best use of time also had the highest rankings in other areas. These examples are presented, not because they were typical, but rather to show the consequences of poor planning and inattention to effective use of time.

Table 11

	Fall	Spring
Instructional time (minutes)	34.60	35.50
Non instructional time (minutes)	19.91	18.55

Impact of Instruction on Student Learning:

The following table shows the overall rankings of the perceived impact of the lesson on students (Table 12) as well as a global assessment of the lesson (Table 13). These rankings are among the most subjective of all the rankings on this protocol. Given this caveat, these overall

rankings reinforce the pattern of rankings in the previous sections of this report. In general, the perceived impact on students understanding, capacity, ability and interest was positive. Very much so indeed. The pattern that has emerged in each section of this report is repeated again here. The Fellows who made good use of time, instruction and content probably had the most positive impact on students. It is impossible to judge whether these conclusions are valid, but visible indications of student interest and motivation seemed to index well with high rankings in these other areas. For example, lessons that began briskly, had substantial content, and had time for questions and clarification appeared to have more students who were directly engaged in the activity and the discussion. Lessons lacking in one or more of those features had fewer students exhibiting these behaviors. This informal observation has important implications for program review and implementation as discussed in the final section of this report.

Not surprisingly, no Fellows provided Level 4 or Level 5 instruction as defined by the capsule rating of the quality of the lesson. According to the standards set forth by the descriptors in the observation protocol, these levels are reserved for highly integrated, reflective, inquiry based instruction. The GK-12 Fellows came close to the characteristics described in Level 4, but none met that standard during these observations. The upper levels of this instructional rubric require that a Fellow do all parts of the lesson very well. In some cases, the Fellow was prevented from getting these scores because they failed to reach a certain subset of students in the classroom. In other cases, the time off task was too detrimental to the overall impact of the lesson. Finally, some lessons might have been exemplary had they incorporated sufficient levels of "sensemaking" and wrap up.

Table 12

	Strongly Negative Effect		Somewhat Negative Effect		Mixed Effect		Somewhat Positive Effect		Strongly Positive Effect	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Students' understanding of mathematics/science as a dynamic	.0%	.0%	9.1%	.0%	27.3%	20.0%	54.5%	50.0%	9.1%	30.0%
Students' understanding of important mathematics/science	.0%	.0%	18.2%	10.0%	45.5%	30.0%	36.4%	40.0%	.0%	20.0%
Students' capacity to carry out their own inquiries.	.0%	.0%	18.2%	10.0%	27.3%	20.0%	45.5%	50.0%	9.1%	20.0%
Students' ability to apply or generalize skills and concepts to	.0%	.0%	27.3%	20.0%	45.5%	30.0%	27.3%	40.0%	.0%	10.0%

Students' self-confidence in doing mathematics/science.	.0%	.0%	9.1%	10.0%	54.5%	30.0%	36.4%	40.0%	.0%	20.0%
Students' interest in and/or appreciation for the discipline.	.0%	.0%	9.1%	10.0%	36.4%	30.0%	54.5%	60.0%	.0%	10.0%

Table 13

		Fall	Spring
Overall assessment of lesson	Level 1: Ineffective Instruction	9.1%	10.0%
	Level 2: Some Elements of Effective Instruction:	27.3%	30.0%
	Level 3: Beginning Stages of Effective Instruction	63.6%	50.0%
	Level 4: Accomplished Effective Instruction	.0%	10.0%
	Level 5: Exemplary Instruction	.0%	.0%

Time Sample Analysis:

In addition to the structured observation protocol a time sample analysis was also conducted in each of the classrooms. During the time sample analysis, 4 students were selected at random (by choosing 4 desks/seats before the start of class). These students were then observed once a minute for 15 minutes. In some cases, several time sample analyses were conducted during a single class section. The time sample analysis captures students' behaviors at regular intervals of time. For example, imagine four students sitting in four corners of a classroom. At 1m 0sec Student 1 is observed. That student is then rated as doing one of the following:

Table 14

Rating:	Behavioral Indicator:
1	Actively off task (talking with peer, writing a note, doing homework for another class, etc.)
2	Passively off task (looking out window, looking at other students, etc.)
3	Passively on task (looking at teacher, or at target activity)
4	Actively on task (participating, completing assignment, etc)

These are not precise measurements. A student who is looking out the window may very well be paying attention, while a student who is looking at the teacher may not be attending at all. Presumably, these two conditions will cancel each other out, and the pattern of results across all Fellows will provide some insight about when students are attending and when they are not. Once all of these time samples are gathered for Fall 2006 and Spring 2007 observation, they will

be compiled into a spreadsheet and analyzed for a variety of predictor variables. At this point, there are not enough data to complete such an analysis. Anecdotally, the results seem to suggest three patterns. First, the time of day seems to be predictive of student attention. Second, gender appears to be related to time on task with girls attending more often than boys. Third, cooperative learning / inquiry based activities seem to be associated with a substantially higher rate of student on-task behaviors. These hypotheses cannot be confirmed until more data is available and that data is coded to permit these analyses. A representative sample from one observation appears in Table 15

Table 15

	S1 F	S2 F	S3 M	S4 M
1206	3	3	3	3
1207	3	3	3	3
1208	4	4	4	4
1209	4	4	2	4
1210	4	4	2	4
1211	4	4	3	3
1212	3	2	2	3
1213	4	4	3	4
1214	4	4	2	4
1215	4	2	1	4
1216	4	4	2	4
1217	4	3	3	2
1218	4	1	3	1
1219	4	1	3	1
1220	4	2	3	1
Average	3.8	3	2.6	3
Female	3.4		Male	2.8

Section 20: Conclusion

The recommendations in this report are suggestions based on direct observations of Fellow's classrooms, as well as anecdotal evidence from Fellow and teacher focus groups. These results are by no means exhaustive, and they are susceptible to rater bias. Despite these limitations, it is important to note that Fellows were warned in advance when they would be observed, and in most cases set the day of the observation at their convenience. Presumably, these results are a best reflection of Fellows' activities in local classrooms. If anything, they likely reflect an *overestimation* of the success of the Fellows. Additionally, these are baseline measures for many of the Fellows with little or no prior teaching experience. While some gains between fall and spring were apparent, the spring observation results suggest there remain areas in need of significant improvement.

These differences in implementation should not be interpreted as the failure of some Fellows and the success of others, but might instead be attributed to a four broad factors that contribute to the success of a Fellow. These are: access to materials, teacher mentoring, teacher cooperation, and Fellows' "independent learning" of best teaching practices. Together, these elements facilitate the success (or explain the difficulties) of a GK-12 Fellow.

Finally, these data suggest the impact the GK-12 program has had on teachers, Fellows, and classroom students. While this is a strong program, there are a number of specific strategies that may be considered for further improvement. A list of these recommendations and suggestions follow in the next section.

Section 21: Recommendations:

The first area, access to materials, can be greatly impacted by the GK-12 program. Some ways the program could support Fellows' access to materials are to:

- Create a repository of shared materials and lessons that all Fellows can access. Currently, Fellows report access to previous Fellows' modules is limited, and finding equipment and supplies is even more difficult. Some Fellows have found their own access to equipment, and if appropriate these should be shared with other Fellows.
- Create a database of materials and personnel around the campus, and across the participating schools, who have agreed to be available to assist the GK-12 Fellows and K-12 students. This is something the Fellows have mentioned a number of times in Focus group settings. Currently, Fellows report using a "lot" of time tracking down and securing the things they need to complete their modules.

The second area, teacher mentoring, and the third area, teacher cooperation are addressed together. During the course of the observations as well as the Fellow and Teacher focus groups, a single theme emerged – "fit." By "fit" the participants were talking about the complicated relationship between Fellow and cooperating teacher. In that relationship, Fellows and teachers had to broker a number of things including:

1. how much independence and freedom would the teacher give to the Fellow
2. how much direct involvement would the teacher have in the planning of the Fellow's lesson
3. what direct involvement would the teacher have during the Fellow's lesson
4. what attention would the Fellow pay in "fitting" the lesson into the curriculum of the teacher
5. what flexibility would the teacher provide the Fellow in determining what might be appropriate for their class
6. what feedback would the teacher provide the Fellow in order for them to improve their effectiveness
7. what scaffolding and support would the teacher provide to make the lesson more successful

8. what assistance would the Fellow accept as a part of the process of mentoring

Two anecdotal examples help to clarify these issues.

In this classroom observation, the cooperating teacher sat and graded papers while the Fellow delivered the lesson to the students. The Fellow had considerable difficulties with the equipment used for the lesson that day and consumed a lot of instructional time with set up. The Fellow also failed to link to students prior knowledge. The Fellow did not ask the students to see if they knew how to solve a particular kind of problem, instead, he went on with the lesson without checking students' understanding. As a result it was a very difficult lesson for both the Fellow and the students with both parties becoming visibly affected in a negative way. The Fellow was sweating profusely because he knew things were not going well, and the students were off task and restless.

This particular example is unusual but illustrative because it showcases so many issues happening at once. In this situation the Fellow was inexperienced and possessed few "in the moment" teacher skills. He also was relatively unprepared to deliver the lesson as evidenced by the equipment not set up in advance, and equipment not prepared for the activity in advance. By the time all of the setup and adjustment were in place, a good deal of instructional time was lost. The reader might be led to believe this is the same lesson mentioned earlier in this report. It is not. Across a total of 11 lessons, 3 exhibited problems of this magnitude. What makes this example particularly troublesome is the inaction of the cooperating teacher. The Fellow had inadequate skills and preparation to be sure, but the cooperating teacher did not provide assistance or guidance at any point during this lesson. That individual might have helped the Fellow check for student understanding, assist in the setup and troubleshooting of equipment or intervene with students who were off task. That did not happen in this class, but the next example shows the contrast of an effective Teacher / Fellow relationship.

In this observation, the Fellow had an activity that required the students to collect data. The weather was not cooperating and the original plan would not work under the circumstances. The Fellow began class after the cooperating teacher took care of the housekeeping (attendance etc.) The non-instruction lead-in to class took less than 3 minutes at which point the Fellow began the lesson. The introduction to that lesson included a review of the concept, checking for students' understanding and then laying out the sequence of events to complete the activity. Also highlighted was the goal of the lesson and what the Fellow expected for outcomes. During this introduction and review the cooperating teacher offered extending links to other projects the students had done, followed up with students that did not appear to understand, and addressed students' off task behaviors. During the activity, the Fellow had all of the materials laid out in order, and quickly distributed the items the students needed to complete the activity. Following this, students began to solve the problems and complete the activity. The cooperating teacher

went from group to group checking for understanding and redirecting students who were not on task by helping them identify the next step they needed to complete. Finally, the students had completed the activity and the last 8 minutes of class were spent reviewing each groups' findings. In two cases the groups answers were wrong. The Fellow discussed with the class where they might have gone wrong. In less than a minute the class discussed this and offered a solution to the group. Following the lesson the Fellow and the teacher talked about what had gone well and where they felt the students were still falling short in their comprehension of the topic. The teacher planned to address those gaps in knowledge the following day as the Fellow's lesson was directly integrated into the unit the cooperating teacher was completing with the class.

This observation shows the effective dynamic between teacher and Fellow, and the obvious communication and planning that went into making this a successful lesson. Clearly, this Fellow had a highly developed set of "in the moment" skills, but this person also had made careful plans in advance of the lesson. The teacher, likewise, had planned the timing for this activity when it would most benefit the class. In addition the cooperating teacher purposefully integrated both the Fellow and the lesson into her curriculum and lesson planning. While it may not be possible for all Fellows' lessons to look like this second example, there are a number of steps the Program can take to increase the likelihood of this second outcome and avoid the first example.

Recommendations for improving Teacher / Fellow teams:

- Have all Fellows and teachers paired early enough in the summer to permit them time to get to know one another, plan together and lay out a schedule before the school year begins
- Have each cooperating teacher complete an evaluation of the Fellow's teaching and lessons. This should be completed relatively early in the placement.
- Have each Fellow complete an evaluation of their cooperating teacher. This evaluation should focus on mentoring, in-class support, and other needs the Fellows has of the cooperating teacher
- Based on these documents and a discussion between the Fellow and the teacher, a set of goals should be established for both the Fellow and the cooperating teacher. These might be quite informal: for example, "Arrive at least 20 minutes before

class is to start to ensure set-up is complete" or "stay in room during labs and activities to assist with groups" or "provide additional assistance with classroom management." A short list of areas in need of additional help or attention would serve to formalize the relationship between the teacher and the Fellow, and could serve to bridge gaps in the Fellow's skillsets

- Program staff would collect copies of these goal plans and monitor progress directly, and through an external evaluator
- Request a videotape of a lesson from each participant. This would give program staff the opportunity to see the kinds of lessons and activities delivered by Fellows in local classrooms.
- Tie continued Fellowship / cooperating teacher status to improvement on identified goals

Fellows "independent learning" is the fourth and final area on this report. The concept of "independent learning" is just that – independent and self directed. Fellows' focus groups and survey responses suggest they must research unfamiliar topics and find information to deliver modules with content not readily familiar to them. Some, but not all, Fellows have applied this approach to learning about instructional practices. Clearly, the intent of the GK-12 program is not to prepare K-12 science teachers. At the same time, certain skills are required to be effective in the classroom. Having experience with ways to group students, design activities and deliver information are basic skills needed by Fellows to work in the public school. During the observation, it was clear that Fellows had different levels of understanding of these instructional approaches.

Additional Comments and Suggestions:

In addition to the specific suggestions made above, a few other ideas may help the GK-12 program improve fidelity of implantation.

- Require all new Fellows to observe with experienced fellows for at least 4 weeks before beginning with a teacher.
- Hire an experienced science teacher to provide feedback and assistance to Fellows who are determined to be "struggling" by the evaluation process mentioned above.

- Provide each new (and returning) Fellow with a packet of materials on designing and delivering effective science education
- Find ways to include the cooperating teachers more directly with the Fellows and the program / University. The cooperating teachers are the primary determinant of whether the program is a success or a failure
- Ensure the consistency of implementation with some type of monitoring system. This could be a random sample of classes that will be observed, or some other reporting method
- Encourage Fellows to meet with students and ask them for feedback about their lessons. Fellows might learn a great deal about what to improve or change by taking this simple step
- Conduct a session between Fellows and all the PI's and discuss how many hours a week should be devoted to this work, and what specific areas the program staff feels the Fellows should focus on
- Identify workshops on teaching science to K-12 students that Fellows could participate in. For example, MMSA holds conferences each year. Fellows might benefit from attending one of these conferences
- Consider having Fellows stop their classroom teaching in May when UMaine's spring semester is over
- Try to focus fellows on just one or two teachers to prevent them from getting stretched too thin
- Consider re-establishing the Wednesday meeting structure used in the summer of 2007 where Fellows and teachers got together to discuss teaching science
- Clarify the program's expectations of Fellows during the summer
- Make meaningful and personal contact with the administration in each of the Fellows' schools
- Identify the roles for each of the PI's and communicate those roles in person with the Fellows

Section 22: Evaluation Instruments

Dear Colleague:
Now that you have been working this academic year as part of the GK-12 Sensors! and RET programs, we would like you to answer some questions about your experience as a teacher participating in the program. This will help the Principal and Co-Principal Investigators to understand better the impacts of the program on teachers and others involved in the program. Please answer the following questions honestly. Your answers will be kept confidential. We ask for your name only so we can tell who has responded. Your name will not be used in the evaluator's report to the Principal and Co-Principal Investigators, and results will be reported in the aggregate and without information that would identify a teacher, school, GK-12 Fellow, or school student. It should take about 20 minutes to complete this questionnaire.
There is very little or no risk to you from participation in this evaluation research, but there will be benefits for all in terms of program improvements. Of course, you may choose not to answer any questions in the survey. If you have any questions about this survey, please contact the evaluator, Research Associate Brian Doore, of the Center for Research and Evaluation (CRE), College of Education and Human Development, at The University of Maine (581-2370 or email brian.doore@umit.maine.edu).

Thank you for your cooperation.

1. Have you been able to incorporate information or techniques you learned last summer into the classes you are teaching this year?
    1. Yes, a lot
    2. Yes, some
    3. Yes, A little
    4. No, haven't been able to
    5. Not this semester, but plan to next semester
    6. Probably won't be able to (Please briefly note why not in the comment box below.

2. How much time and effort do you think it took to mentor the graduate Fellow(s) you work with to improve their teaching skills this year? (Please circle the number of, or put an X beside, one answer)
    1. Considerable time and effort
    2. Little time and effort
    3. No time and effort

3. To what extent did your experience with the RET/GK-12 Sensors projects this year improve your own teaching effectiveness? (Please circle the number of one answer)
    1. Greatly improve my teaching effectiveness
    2. Somewhat improve my teaching effectiveness
    3. No change in my teaching effectiveness
    4. Decline in my teaching effectiveness

4. To what extent do you think participation in the RET/GK-12 programs this year helped you align (or maintain the alignment of) your curriculum with state, local, or national standards? (Please circle/X the number of one answer)

1. Will help significantly
2. Will help somewhat
3. Will help only a little
4. Will not help at all

5. To what extent do you expect participation in the RET/GK-12 programs this year to help you integrate (or further integrate) technology into your teaching? (Please circle/X the number of one answer)

1. Will help significantly
2. Will help somewhat
3. Will help only a little
4. Will not help at all

6. In general, what do you think the impact of the GK-12 teaching Fellows was on the students in your classes this year? (Please circle/X the number of one answer)

1. Will greatly improve students' motivation to study science, technology, engineering and math
2. Will somewhat improve their motivation to study science, technology, engineering and math
3. Will have little impact on their motivation to study science, technology, engineering and math
4. Will reduce their motivation to study science, technology, engineering and math

7. Overall, how would you characterize your experience with the RET/GK-12 Sensors programs this year? (Please circle/X the number of one answer)

1. Very rewarding
2. Somewhat rewarding
3. Neither rewarding nor disappointing
4. Somewhat disappointing
5. Very disappointing

8. What recommendations do you have for improving the GK-12 Sensors programs?

The University of Maine
GK-12 Sensors! Graduate Teaching Fellows Year-end Questionnaire
Spring 2007

As part of the program evaluation, we ask that you complete this questionnaire about your background and your experiences with the GK-12 Sensors! program. This evaluation questionnaire is being distributed by the Center for Research and Evaluation (CRE) of the College of Education and Human Development at The University of Maine.

Completing this questionnaire is voluntary. You may skip any question you wish, or not fill it out at all. Individual responses will remain confidential. Results will be reported in the aggregate and will not disclose individual Fellows' identities or those of participating teachers or schools.

If you decide to answer these questions, and of course we hope you will, please either email it back as an attachment or seal your completed questionnaire in an envelope and mail it back to the evaluator at the address shown at the end of the questionnaire. If you have questions about the evaluation or how the resulting data will be used, please contact the evaluator, Research Associate Brian Doore (telephone 581-2370, or brian.doore@umit.maine.edu).

This is a Microsoft Word document. If you plan to use it to enter your responses and send back as an attachment to an email, please put an X in front of the number of your answers where there is an answer list provided, and type in the spaces provided if the question asks for a narrative response.

1. What is the highest level graduate degree you are currently pursing? *(Please circle the number of, or put an X beside, one answer)*

1 M.S.
2 Ph.D.

2. What will be the title of your graduate degree? *(Please write your answer in the space below)*

3. Did getting a GK-12 Fellowship influence your decision to enroll in graduate school at UMaine? *(Please circle/X the number of one answer)*

1 Yes
2 No

4. If you answered yes to question 3, please briefly explain how getting the GK-12 Fellowship affected your decision. *(If this question does not apply to you, leave it blank and go to the next question).*

5. When you enrolled in graduate school at the University of Maine were you planning on getting a Ph.D.? *(Circle/X the number of one answer)*

1 Yes, I enrolled in a Ph.D. program
2 Yes, I enrolled in a M.S. program and plan to continue to a Ph.D.
3 Perhaps. I am enrolled in a M.S. program and may continue to a Ph.D. program
4 No, I plan to stop with a M.S. degree
5 Not sure—I will wait until after the M.S. degree to decide

6. Please indicate how much, if at all, your experience as a GK-12 Fellow has affected your interest in pursuing a Ph.D. *(Circle/X the number of one answer)*

1 I enrolled with the intention of getting a Ph.D., and my intention hasn't changed
2 Much more likely to get a Ph.D.
3 Somewhat more likely
4 Somewhat less likely
5 Much less likely
6 I intended to stop at a M.S. degree, and my intention hasn't changed

7. Before becoming a GK-12 Fellow, had you ever considered becoming a middle or high school teacher? *(Circle/X the number of one answer)*

1 Yes
2 No

8. How has your experience as a GK-12 Fellow affected your interest in teaching at the middle or high school level? *(Circle/X the number of one answer)*

1 I was sure that I was going to teach, and that hasn't changed
2 Much more interested
3 Somewhat more interested
4 Somewhat less interested
5 Much less interested
6 I never expected to teach, and that hasn't changed

9. If you are interested in teaching, what subjects would you like to teach? *(If this question does not apply to you, leave it blank and go on to the next question.)*

10. Are you currently working toward obtaining a teaching certificate? *(Circle/X the number of one answer)*

1 Already have a teaching certificate
2 Yes
3 No, but plan to start soon
4 No, not planning to get one

11. Do you plan to teach at the college/university level? *(Circle/X the number of one answer)*

1 Yes
2 No
3 Not sure

12. Please list the titles of the high school and/or middle school courses in which you worked over the past current academic year. Please list all your placements in the table below and check the boxes for the semester and grade level information.

Course title If you taught multiple sections or classes with the same title, indicate in parentheses after the course title the number of sections or times the class was offered.	Semester		Grade level	
	Fall 2006	Spring 2007	Middle school	High school
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐

13. To what extent has your experience as a GK-12 Fellow improved your teaching skills? *(Circle/X the number of one answer)*

1 They were very good before, and they haven't changed
2 Greatly improved
3 Somewhat improved
4 Declined
5 They weren't very good before, and they haven't changed

14. Do you think being a GK-12 Fellow has helped you make better professional presentations? *(Circle/X the number of one answer)*

1 Yes
2 No
3 Not sure

15. Has being a GK-12 Fellow improved your communications skills? *(Circle/X the number of one answer)*

1 Yes
2 No
3 Not sure

16. Has your experience this year as a GK-12 Fellow affected your familiarity with active/cooperative learning techniques? *(Circle/X the number of one answer)*

1 I was quite familiar with them before, and that hasn't changed
2 Much more familiar
3 Somewhat more familiar
4 I don't know what is meant by "active/cooperative learning techniques"

17. If you used active/cooperative learning techniques that you found to be particularly useful, please note them briefly in the space below. *(If this question does not apply to you, leave it blank and go on to the next question.)*

18. List below up to three teaching modules you substantially used, developed, or modified as a GK-12 Fellow this academic year. *(If this question does not apply to you, leave it blank and go on to the next question.)*

19. In general, how would you characterize the impact your involvement as a GK-12 Fellow on the middle and high school students in your classes? *(Circle/X the number of one answer)*

1 Greatly improved their motivation to study science, technology engineering, and mathematics (STEM)
2 Somewhat improved their motivation to study STEM
3 Had little impact on their motivation to study STEM
4 Somewhat reduced their motivation to study STEM
5 Greatly reduced their motivation to study STEM

20. If you think that your involvement <u>improved</u> the motivation of <u>at least some</u> students to study STEM, please briefly note in the space below specific examples or experiences you had that led you to that conclusion. *(If this question does not apply to you, leave it blank and go on to the next question.)*

21. If you think that your involvement did not improve the motivation of some students to study STEM, or it reduced their motivation, please explain why in the space below. *(If this question does not apply to you, leave it blank and go on to the next question.)*

22. Has being a GK-12 Fellow enhanced your thesis research? *(Circle/X the number of one answer)*

1 Yes
2 No
3 Not sure

23. If you answered yes to question 22, please explain how in the space below. *(If this question does not apply to you, leave it blank and go on to the next question.)*

24. If you answered no to question 22, please explain why not. *(If this question does not apply to you, leave it blank and go on to the next question.)*

25. Please **rank** from **most helpful (1)** to **least helpful (5)** each of the following groups of participants in the GK-12 Sensors program in terms of the extent to which they helped you improve your teaching skills. (*Put a number from 1 (most helpful) to 5 (least helpful) in the blank in front of each item.)*

___University faculty members
___High school and/or middle school teachers
___Other GK-12 Fellows
___Literature and textbooks on instructional techniques
___High school and/or middle school students you encountered

Any other? Please specify:_____

26. Please rate how your experience this year as a GK-12 Fellow affected your interest in working (including, but not limited to teaching) in Maine after completing your graduate degree. *(Circle/X the number of one answer)*

1 Had always planned to work in Maine, and that hasn't changed
2 Much more interested
3 Somewhat more interested
4 No change
5 Somewhat less interested
6 Much less interested
7 Never planned to work in Maine, and that hasn't changed

27. Overall, my experience as a GK-12 Fellow has been: *(Circle/X the number of one answer)*

1 Very rewarding
2 Somewhat rewarding
3 Neither rewarding nor disappointing
4 Somewhat disappointing
5 Very disappointing

28. What surprised you most about the GK-12 program and your teaching experience this past year? Please briefly describe in the space below.

29. What suggestions do you have for improving the program for future GK-12 Fellows? *Please write your recommendations in the space below.*

Thank you for your time and your thoughtful answers.

If you have completed this questionnaire on your computer using a word-processing program, please return it as an attachment to an email addressed to brian.doore@umit.maine.edu . If you decide to print it out and mail it conventionally, please send it to Brian Doore, Center for Research and Evaluation, 5766 Shibles Hall, University of Maine, Orono, Maine 04469-5766.

The University of Maine
RET/GK-12 Sensors!
Questionnaire for Teachers—Spring 2007

Dear Colleague:

Now that you have been working this academic year as part of the GK-12 Sensors! and RET programs, we would like you to answer some questions about your experience as a teacher participating in the program. This will help the Principal and Co-Principal Investigators to understand better the impacts of the program on teachers and others involved in the program. Please answer the following questions honestly. Your answers will be kept confidential. We ask for your name only so we can tell who has responded. Your name will not be used in the evaluator's report to the Principal and Co-Principal Investigators, and results will be reported in the aggregate and without information that would identify a teacher, school, GK-12 Fellow, or school student. It should take about 20 minutes to complete this questionnaire.

There is very little or no risk to you from participation in this evaluation research, but there will be benefits for all in terms of program improvements. Of course, you may choose not to answer any questions in the survey. If you have any questions about this survey, please contact the evaluator, Research Associate Suzanne Hart, of the Center for Research and Evaluation (CRE), College of Education and Human Development, at The University of Maine (581-2400 or email shart@maine.edu).

Thank you for your cooperation.

Your Name:

The school(s) in which you had a GK-12 Fellow placed with you this year (2006-2007):

We would like some background information about you

Your undergraduate degree major subject:

Undergraduate degree year:

Undergraduate degree college/university:

Graduate degree major subject(s):

Graduate degree year(s):

Graduate degree school(s):

Years of teaching experience at this school:

Total years of teaching experience:

For how many semesters, including this one, have you worked with a GK-12 Fellow in at least one of your courses? *(Please enter the number of semesters here: _____)*

Please list the titles of the high school and/or middle school courses you are teaching this semester (Fall 2005) in which you work with GK-12 Sensors! Fellows, check the boxes for the grade level information, and indicate how many students are in each course.

Course titles **If you teach multiple sections or courses with the same title**, please **list each section or course separately** (you can use ditto marks) and indicate the grade level and number of students in each of the sections or classes.	Grade level		Number of students
	Middle school	High school	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

The next questions are about your experiences with the **summer program (if applicable) in 2006**

The course *Introduction to Sensors*	**Not at all**	**Not very**	**Somewhat**	**Quite**	**Very**
1. How useful for your teaching was the course *Introduction to Sensors*?	☐	☐	☐	☐	☐
2. How useful to your own professional development was the course *Introduction to Sensors* to you personally?	☐	☐	☐	☐	☐
3. How effectively was the course *Introduction to Sensors* presented?	☐	☐	☐	☐	☐
The research project					
4. How useful for your teaching was your participation in a *research project*?	☐	☐	☐	☐	☐
5. How useful for your own professional development was your participation in a *research project*?	☐	☐	☐	☐	☐

Your mentor	Not at all	Not very	Somewhat	Quite	Very
6. How important was your contribution to the *research project* you worked on?	☐	☐	☐	☐	☐
7. How helpful for your teaching was your research project *mentor*?	☐	☐	☐	☐	☐
8. How helpful for your own professional development was your research project *mentor*?	☐	☐	☐	☐	☐
The presentations					
9. How useful for your teaching was preparing and delivering your *presentation*?	☐	☐	☐	☐	☐
10. How useful for your own professional development was preparing and delivering your *presentation*?	☐	☐	☐	☐	☐
11. How useful for your teaching was it to hear the *presentations* of others in the program?	☐	☐	☐	☐	☐
12. How useful for your own professional development was it to hear the *presentations* of others?	☐	☐	☐	☐	☐

13. Have you been able to incorporate information or techniques you learned last summer into the classes you are teaching this fall?

1. Yes, a lot
2. Yes, some
3. Yes, A little
4. No, haven't been able to
5. Not this semester, but plan to next semester
6. Probably won't be able to *(Please briefly note why not:* _____
_____)

The next questions are about your experiences with the RET/GK-12 Sensors projects this year (2006-2007)

14. How much time and effort do you think it will take to mentor the graduate Fellow(s) you work with to improve their teaching skills this semester? *(Please circle the number of, or put an X beside, one answer)*

1. Considerable time and effort
2. Little time and effort
3. No time and effort

15. To what extent do you expect your experience with the RET/GK-12 Sensors projects this semester year improve your own teaching effectiveness? *(Please circle the number of one answer)*

1. Greatly improve my teaching effectiveness
2. Somewhat improve my teaching effectiveness
3. No change in my teaching effectiveness
4. Decline in my teaching effectiveness

16. To what extent do you think participation in the RET/GK-12 programs this semester will help you align (or maintain the alignment of) your curriculum with state, local, or national standards? *(Please circle/X the number of one answer)*

1. Will help significantly
2. Will help somewhat
3. Will help only a little
4. Will not help at all

17. To what extent do you expect participation in the RET/GK-12 programs this semester to help you integrate (or further integrate) technology into your teaching? *(Please circle/X the number of one answer)*

1. Will help significantly
2. Will help somewhat
3. Will help only a little
4. Will not help at all

18. In general, what do you expect will be the impact of the GK-12 teaching Fellows on the students in your classes this semester? *(Please circle/X the number of one answer)*

1. Will greatly improve students' motivation to study science, technology, engineering and math
2. Will somewhat improve their motivation to study science, technology, engineering and math
3. Will have little impact on their motivation to study science, technology, engineering and math
4. Will reduce their motivation to study science, technology, engineering and math

19. Overall, how would you characterize your experience with the RET/GK-12 Sensors programs this semester so far? *(Please circle/X the number of one answer)*

1. Very rewarding
2. Somewhat rewarding
3. Neither rewarding nor disappointing
4. Somewhat disappointing
5. Very disappointing

And finally…

20. What recommendations do you have for improving the RET and/or GK-12 Sensors programs?

Thank you for your time and your thoughtful answers.

If you have completed this questionnaire on your computer using a word-processing program, please return it as an attachment to an email addressed to shart@maine.edu . If you have completed a printed version, please mail it to Suzanne Hart, Center for Research and Evaluation, 5766 Shibles Hall, University of Maine, Orono, Maine 04469-5766.

GK-12 Sensors! Focus Group:

Agenda:

1) Overview: purpose of evaluation, increased attention from NSF, confidentiality of answers – evaluator's first duty is to the participants' privacy.
2) Permission to tape record
3) Section 1) "The Fellowship of the Sensors"
    a. What worked well with the process of getting into the program? What didn't?
    b. Talk about the administrative aspects of the program:
        i. Program Director
        ii. Principal Investigators
        iii. Support Staff
    c. Reporting requirements of the program (journals, reports, submission of lessons & activities)
        i. How would you describe these?
        ii. What could have been improved?
4) Section 2) "The Two Roles"
    a. Talk about the dual responsibilities of the two roles: teaching and research.
        i. How did you balance your time? What do you wish you had done differently?
        ii. What did the schedule of your year look like? Was it consistent? Were there patterns of activity?
5) Section 3) School Experiences: What were the cooperating teachers like?
6) Challenges, benefits, things to improve?
7) Other:

Appendix A: Horizon Research's "Inside the Classroom: Observation and Analytic Protocol"

(Follows on next page.)

National Science Foundation
University of Maine
GK-12 Sensors!

2006-07 Annual Report

I.A. Principal Investigator Report

Please refer to tables 1-5 on the following pages.

Table 1. Senior Personnel. 2007-08

Name	Position	Description of position	Length of time worked on project	Institutional affiliation & position	Contribution statement
John Vetelino	Principal Investigator	Makes final decisions on fellow selection, directs fellow activities, sets guidelines for module development, facilitates communication between GK-12 Sensors! schools, fellows and UM faculty, attends GK-12-related conferences.	5.5 yrs	University of Maine Department of Electrical & Computer Engineering, Professor	Has worked for at least 160 hours in the past reporting year of the project
Constance Holden	Co-Principal Investigator	Brings K-12 teaching experience to the task of supporting and training GK-12 fellows, interacting with civic leaders, helping administer the program.	5.5 yrs	University of Maine Department of Spatial Information Science & Engineering, Instructor	Has worked for less than 160 hours in the past reporting year of the project
Stephen Godsoe	Co-Principal Investigator	An active team member in the classroom helping GK-12 fellows, directs program collaboration with state and city agencies, works to support the program with new initiatives, organizes GK-12 activities at Bangor High School, pairing fellows with appropriate teachers, producing GK-12 press releases for the school paper, and regularly communicating with GK-12 satellite schools on issues relating to technology in the classroom.	5.5 yrs	Bangor High School Mathematics Department, Chair	Has worked for less than 160 hours in the past reporting year of the project
Brian Doore	Program Evaluator	Resposible for all aspects of program evaluation: Administers surveys, focus groups, interviews and classroom observations; analyzes & reports evaluation data to PI and co-PIs.	2 yrs	Center for Research and Evaluation, Research Associate	Has worked for at least 160 hours in the past reporting year of the project
Joe Arsenault	Program Coordinator	Coordinates GK-12 Sensors activities and meetings; acts as liaison between Co-PIs, fellows and teachers; prepares articles, reports and informational presentations; assists fellows in developing modules and conference presentations; advocates for ongoing support; works with fellows to establish auxiliary support for GK-12 related activities.	3.5 years	University of Maine Department of Electrical & Computer Engineering, Staff Technical Writer	Has worked for at least 160 hours in the past reporting year of the project

Table 2. Graduate Students. 2007-08 (Page 1 of 2)

Name	Year in graduate program	Major	Research topic	Statement of graduate location & nature of graduate work	Ethnicity & Gender
Jason Bolton	2nd year MS	Food Sciences	Developing a Lobster Vitality Optical Sensor	UM Department of Food Science and Human Nutrition, Lobster Institute, and Laboratory for Surface Sciences and Technology (LASST), doing research, collecting data	Caucasian, male
Aaron Clark	4th year PhD	Chemical Engineering	Correlation of Microhotplate Metal Oxide Sensor Response to Catalytic Fluorocarbon Decomposition Activity	UM Department of Chemical and Biological Engineering, doing research, collecting data	Caucasian, male
Stacy Doore	1st year MS	Spatial Information Engineering	Developing a Conceptual Model of a Space-Time Information System Able to Integrate, Analyze, and Visualize Individual Geospatial Lifelines and Sensor Data Collected from Environmental Monitoring Systems	UM Department of Spatial Information Science and Engineering, determining research focus, collecting data	Caucasian, female
Lester French	5th year PhD	Materials Science	Equivalent Circuit Model for Lateral Field Excited Acoustic Wave Sensor	UM Laboratory for Surface Science and Technology, writing dissertation	Caucasian, male
Raymond Kennard	5th year PhD	Chemical Engineering	Mesoporous Thin Film Fabrication & Characterization	UM Department of Chemical and Biological Engineering, doing research, collecting data	Caucasian, male

Table 2. Graduate Students. 2007-08 (Page 2 of 2)

Name	Year in graduate program	Major	Research topic	Statement of graduate location & nature of graduate work	Ethnicity & Gender
Christie Mahaffey	3rd year PhD	Interdisciplinary: Mechanical Engineering, Marine Sciences	Examining Acoustic Signatures of Large Ships and Finback Whale Biology and Movement Patterns to Reduce Ship-Whale Collisions	UM Department of Mechanical Engineering, School of Marine Sciences, doing research, collecting data	Caucasian, female
Donald McCann	2nd year PhD	Electrical Engineeering	High Frequency Bulk Acoustic Wave Sensors	UM Laboratory for Surface Science and Technology, Department of Electrical and Computer Engineering, writing dissertation	Caucasian, male
Kristopher Sgambato	2nd year MS	Electrical Engineeering	Lateral Field Excited Acoustic Wave Rate Monitor	UM Department of Eletrical and Computer Engineering, doing research, collecting data	Caucasian, male
Ali Shareef	2nd year MS	Computer Engineering	Localization and Energy Modeling in Wireles Sensor Networks	UM Department of Eletrical and Computer Engineering, doing research, collecting data, writing thesis	Asian, male
William Spratt	2nd year MS	Mechanical Engineering	Guided-Wave Ultrasonic Sensor for Tempurature Measurements	UM Department of Eletrical and Computer Engineering, doing research, collecting data	Caucasian, male
Mitchell Wark	2nd year MS	Computer Engineering	Chemical & Biological Acoustic Wave Sensors	UM Department of Eletrical and Computer Engineering, doing research, collecting data	Caucasian, male

Table 3. Fellows Tracking 2002-2007 (Page 1 of 2)

Last Name	First Name	Graduation Status	Degree Obtained	Current Position	E-mail	Phone
Berkenpas	Eric	Graduate	MS Electrical Eng.	Electrical Engineer, Remote Imaging Department, National Geographic Society, Washington, D.C.	n/a	800.548.9797
Donovan	Danielle	Graduate	MS Spatial Info Eng.	Science Teacher, Hampden Academy, Hampden, ME	ddonovan@sad22.us	207.862.3791
Duy	Janice	3rd Yr Ph.D	BS Electrical Eng.	UM Graduate Student	janice.duy@umit.maine.edu	n/a
Gallimore	Dana	5th Yr. Ph.D	BS Electrical Eng.	UM Graduate Student	dana.gallimore@umit.maine.edu	n/a
Hedefine	Eeva	Graduate	MS Spatial Info Eng.	Staff Engineer, James W. Sewall Co., Old Town, ME	ehedefine@jws.com	207.827.4456
Isenberg	Douglas	None	BS Electrical Eng.	Unknown	n/a	n/a
Kenney	Crystal	Graduate	MS Electrical Eng.	Ph.D Candidate, Nanoelectronics Lab, Stanford University	ckenney@stanford.edu	
Krassikoff	John	Graduate	Ph.D Physics	Raytheon Missile Systems Company, m/s 840/9, Tucson, AZ 85706	John_Krassikoff@raytheon.com	n/a
Lampron	Kenna	None	BS Electrical Eng.	Unknown	n/a	n/a
Lewark	Michael	Graduate	MS Electrical Eng.	Electrical Engineer, 3-C Electric Company, 2 Stone Ledge Drive, Lewiston, ME 02056	n/a	508.881.3911
Martin	Andrea	Graduate	Ph.D Chemistry	High School Chemistry Teacher, teaching in Indiana, details unavailable	n/a	n/a
McCarthy	Erik	3rd Yr Ph.D	BS Electrical Eng.	UM Graduate Student	erik.mccarthy@umit.maine.edu	n/a
Nagy	Edwin	5th Yr. Ph.D	MS Civil Eng.	UM Graduate Student	edwin.nagy@umit.maine.edu	207.581.2071
Neumann	Bradley	Graduate	MS Resource Economics & Policy	Land Policy Educator, MSU Extension--St. Joseph County, 612 E. Main Street, Centreville, MI 49032	neuman36@msu.edu	(p) 269.467.5522 (f) 269.467.5641

Table 3. Fellows Tracking 2002-2007 (Page 2 of 2)

Last Name	First Name	Graduation Status	Degree Obtained	Current Position	E-mail	Phone
Parks	Jesse	None	BS Electrical Eng.	Unknown	n/a	919.360.1721
Pinkham	Wade	Graduate	MS Electrical Eng.	Staff Engineer, Bath Iron Works, Bath, ME	wade.pinkham@umit.maine.edu	207.438.2071
Pitcher	Stephanie	Graduate	MS Electrical Eng.	Defense Control Management Agency, Tewksbury, MA	stephanie.pitcher@dcma.mil	978.858.1802
Puckett	Anthony	Graduate	Ph.D. Mechanical Eng.	Technical Staff Member, ESA-WR, MS-T001, Los Alamos National Laboratory, PO Box 1663, Los Alamos, NM 87545	apuckett@lanl.gov	505.663.5130
Thiele	Jeremy	Graduate	MS Electrical Eng.	Electrical Engineer, Hascom Air Force Base, Hanscom Field, MA	jeremy.thiele@umit.maine.edu	781.377.3846
Walker	Judith	Graduate	MS Resource Economics & Policy	Economist, URS Corporation, 200 Orchard Ride Driver, Suite 101, Gaithersburg, MD 20878	judith_walker@urscorp.com	(c) 301.542.3124 (o) 301.258.5912
Woodard	Becky	Graduate	Ph.D Biology	Postdoctoral Research Associate, Woods Hole Oceanographic Institution, 8 Millfield St., Woods Hole, MA 02543	woodward_becky@yahoo.com	508.289.3419
York	Chris	None	BS Electrical Eng.	U.S. Navy Shipyard, Portsmouth, ME	n/a	207.438.1000

Table 4A. Organizational Partners for GK-12: Sensors! (Page 1 of 3)

Name	Type	Characteristics	Description of activities	Number of fellows & Teachers	Subject area & grade level fellow & teacher teams teaching
Bangor High School	Public High School	Type of School: Urban;% of free or reduced price Lunch: 19.66%; % minority: 8%. Academic standing: Exceeds state averages in critical reading, writing and mathematics. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	2 Fellows, 2 Teachers	GIS (9-12), Geography (9-12), Computer Science (9-12)
Brewer High School	Public High School	Type of School: Urban; % of free or reduced price Lunch: 20.52%; % minority: 3%. Academic standing: Meet state averages in writing and mathematics; fails to meet state average in critical reading. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum.	1 Fellow, 3 Teachers	Physical Science (9)
Brewer Middle School	Public Middle School	Type of School: Rural; % of free or reduced price lunch: 31.1%; % minority: 4%. Academic standing: Meets state averages in reading, mathematics, science & technology, and writing. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 1 Teacher	7th-grade science
Bucksport High School	Public High School	Type of School: Urban; % of free or reduced price lunch: 29.54%; % minority: 2%. Academic standing: Fails to meet state averages in critical reading, writing and mathematics. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 2 Teachers	Physics (12), Chemistry (11), Physical Science (9)
Bucksport Middle School	Public Middle School	Type of School: Urban; % of free or reduced price lunch: 44.78%; % minority: 1%. Academic standing: Fails to meet state averages in critical reading, writing and mathematics. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum.	1 Fellow, 2 Teachers	7th-8th grade sciences

Table 4A. Organizational Partners for GK-12: Sensors! (Page 2 of 3)

Name	Type	Characteristics	Description of activities	Number of fellows & Teachers	Subject area & grade level fellow & teacher teams teaching
Caravel Middle School	Public Middle School	Type of School: Rural; % of free or reduced price lunch: 32.72%; % minority: 1%. Academic standing: Exceeds state average in science & technology; fails to meet state averages in reading, mathematics and writing. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 1 Teacher	8th-grade science
William S. Cohen School	Public Middle School	Type of School: Urban; % of free or reduced price lunch: 26.37%; % minority: 8%. Academic standing: Exceeds state averages in reading, mathematics, science & technology and writing. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 2 Teachers	8th-grade physical science, 8th-grade accelerated physical science
James F. Doughty School	Public Middle School	Type of School: Urban; % of free or reduced price lunch: 46.15%; % minority: 8%. Academic standing: Exceeds state averages in reading, mathematics, science & technology and writing. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 2 Teachers	7th-grade life science, 8th-grade applied science
Ellsworth High School	Public High School	Type of School: Suburban; % of free or reduced price lunch: 25.55%; % minority: 4%; Academic Standing: Fails to meet state averages in critical reading, writing and mathematics. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 2 Teachers	Algebra I (9-10), Algebra II (10-11), Applied Algebra (9-11), Geometry (10-11)

Table 4A. Organizational Partners for GK-12: Sensors! (Page 3 of 3)

Name	Type	Characteristics	Description of activities	Number of fellows & Teachers	Subject area & grade level fellow & teacher teams teaching
Hermon High School	Public High School	Type of School: Rural; % of free or reduced price lunch: 19.29%; % minority: 2%. Academic Standing: Exceeds state average in mathematics, meets average in writing, fails to meet average in critical reading. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum.	1 Fellow, 5 Teachers	Physics (12), Honors Physics (12), Conceptual Chemistry (11-12), Chemistry (11), Algebra II (10-11)
Indian Island School	Penobscot Nation/Bureau of Indian Affairs Grant School	Type of School: Rural; % of free or reduced price lunch: 83.61%; % minority: 96.4%. Academic standing: Fails to meet tate averages in reading, mathematics, science & technology and writing. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 1 Teacher	7th-grade science & language arts
Old Town High School	Public High School	Type of School: Rural; % of free or reduced price lunch: 30.1%; % minority: 7%; Academic standing: Fails to meet state average in critical reading, writing and mathematics. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 1 Teacher	Biology (10), AP Biology (10), Wildlife Ecology (10-11)
Reeds Brook Middle School	Public Middle School	Type of School: Rural; % of free or reduced price lunch: 15.88%; % minority: 2%. Academic standing: Exceeds state averages in reading, mathematics, science & technology and writing. (For federal standing, see Table 4B.)	Teachers participate in summer workshop provided by project; assist fellows build sensors-integrated activities into school's science curriculum; lead teachers assist PI & co-PIs steer program through meetings during school year	1 Fellow, 3 Teachers	8th-grade science, 7th-grade life science, 6th-grade science & social studies

Table 4B. 2006-07 participating school "No Child Left Behind" standing

Abbreviations:
APY Adequate Yearly Progress
CIPS1 Schools did not make AYP in the same subject for two years
CIPS2 Schools did not make AYP in the same subject for three years

Identification Codes: *Groups that did not make AYP*

E	Economically Disadvantaged
S	Students with Disabilities
W	Whole School

School District	School Name	Title 1 School	Reading Status & Identification Codes	Math Status & Identification Codes
Bangor School Dept	Bangor High School		CIPS1 05-06 E, S	Monitor 05-06 E
Bangor School Dept	James F. Doughty School	yes	Made AYP	Made AYP
Bangor School Dept.	William S Cohen School		Made AYP	Made AYP
Brewer School Dept	Brewer High School		CIPS2 05-06 W, E, S	CIPS1 05-06 W, E, S
Brewer School Dept	Brewer Middle School		Made AYP	Made AYP
Bucksport School Dept	Bucksport High School		CIPS2 05-06 W, E	CIPS1 05-06 W
Bucksport School Dept	Bucksport Middle School	yes	Monitor S	Made AYP
Ellsworth School Dept	Ellsworth High School		Made AYP	Made AYP
Hermon School Dept	Hermon High School		CIPS1 05-06 W, E	Made AYP
Hermon School Dept	Hermon Middle School		Made AYP	Made AYP
Old Town School Dept	Old Town High School		CIPS1 05-06 W, E	Made AYP
S.A.D. 22	Reeds Brook Middle School		Made AYP	CIPS1- status on hold
S.A.D. 23	Caravel Middle School	yes	CIPS1 05-06 S	Monitor S

Table 5. Other 2006-07 collaborators with GK-12 Sensors!

Name	Type of Contribution	Statement of Contribution
University of Maine Office of Vice President for Research	Financial	$30,000 to fund one GK-12: Sensors! fellowship.
University of Maine Graduate School	Financial	$4,826 in tuition waivers and related fees for fellowship UM funded.
University of Maine Office of Vice President for Research, Graduate School	Facilities, Financial	Full support as PI explores how best to integrate INT 570, "Emerging Science and Technology Integration Into K-12 Classrooms" into UM ongoing graduate curriculum as a requirement for PhD graduate students in science and engineering.
Laboratory for Surface Science and Technology (LASST), Dr. Robert Lad,	Facilities	Provides access to facility for middle/high school tour.
Dr. Rodney Bushway, Professor of Food Sciences, UM	Fellow support	Serves as advisor to GK-12 fellow Jason Bolton.
Dr. William J. Desisto, Assistant Professor of Chemical Engineering, UM	Fellow support	Serves as advisor to GK-12 fellow Raymond Kennard.
Dr. Michael Peterson, Professor of Mechanical Engineering, UM	Fellow support	Serves as advisor to GK-12 fellow Christie Mahaffey.
Dr. John F. Vetelino, Professor of Electrical Engineering, UM	Fellow support	Serves as advisor to GK-12 fellows Lester French, Don McCann, Kris Sgambato, and Kyle Spratt.
Dr. Clayton Wheeler, Assistant Professor of Chemical and Biological Engineering, UM	Fellow support	Serves as advisor to GK-12 fellow Aaron Clark.
Dr. Yifeng Zhu, Assistant Professor of Electrical and Computer Engineering, UM	Fellow support	Serves as advisor to GK-12 fellow Ali Shareef.
Dr. David Frankel, Senior UM Research Scientist	In-kind	Facilitated tours of various UM laboratories for visiting GK-12 participant high/middle school students.
Dr. George Bernhardt, UM Research Scientist	In-kind	Facilitated tours of various UM laboratories for visiting GK-12 participant high/middle school students.
Michael Call, UM Research Engineer	In-kind	Facilitated tours of various UM laboratories for visiting GK-12 participant high/middle school students.
Peter Arno, Assistant Police Chief, Bangor	In-kind, Collaborative research	Interacts with Bangor High School students enrolled in "Introduction to GIS," participating teacher Margaret Chernosky and Fellow Stacy Doore, providing projects, data and feedback throughout academic year.

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I.B. Project Summary

I.B.1 Goals and Activities

I.B 1.1 Long and short term goals and objectives for fellows, faculty and institutions.

According to the proposal for Track 2, *GK-12: Sensors!*, its goal is to capitalize upon UM's interdisciplinary, state-of-the-art sensor science and engineering resources to establish strong partnerships with middle and high schools, benefiting GK-12 fellows, teachers, middle and high school students, senior personnel, and business and community stakeholders. Program sustainability, a comprehensive evaluation, and proactive dissemination are also critical.

Track II long-term goals

- Encouraging business innovation in Maine through a more educated workforce and facilitating greater industry involvement in Maine high schools
- Improving the public perception of higher education
- Encouraging Maine students to attain undergraduate and graduate degrees, especially in STEM fields
- Encouraging Maine students to attend UMaine or to return to Maine to expand the number of scientists and engineers contributing to the state's economy
- Disseminating model curricula so that other research topics (i.e. wireless communications, nanotechnology, genomics etc.) can fuel the development of other innovative curricula in the nation's high schools
- Preparing Maine students for careers utilizing sensors
- Encouraging interdisciplinary research and teaching related to sensor science and engineering
- Fostering long-term partnerships between the schools, UMaine, and community groups

Track II program objectives

- Developing strong and sustainable partnerships with middle and high school teachers by engaging them in state-of-the-art sensor research activities and topics
- Motivating students to pursue STEM education and careers
- Improving the communications and pedagogical skills of the fellows, while fostering a lifelong commitment to STEM education at all levels
- Encouraging more and meaningful private sector engagement in Maine's public schools
- Transferring sensor-related STEM knowledge and skills to community partners to help them fulfill their missions
- Implementing a comprehensive evaluation plan that extensively documents and analyzes *GK-12: Sensors!* outcomes to provide a research base to inform development of future university/K-12 partnerships, particularly within rural states
- Intensifying the dissemination of best practices at state, regional, and national levels
- Achieving sustainability through institutional and/or state funding for fellowships and new graduate courses

Objectives formulated from recommendations of 2006-07 Evaluation Findings

EvO1. Establish a regular form of communication (such as a newsletter) from the PI and co-PI's to fellows, teachers and cooperating faculty

EvO2. Maintain a more consistent level of support for Fellows throughout the academic year *[NOTE: Clarification of this objective is being pursued with Fellows and in discussion with the 2007-08 Lead Participating Teacher Advisory Board (LPTAB) throughout 2007-08.]*

EvO3. Have Fellows meet regularly throughout the academic year to discuss modules, instruction and their own research; meetings to be conducted without program staff, except by invitation

EvO4. Bring together selected high school science teachers and university teaching faculty several times a year to review Fellows' work, provide feedback for improvement, and identify ways to sustain this project beyond NSF funding *[NOTE: Implementing EvO4 has been delayed indefinitely as a result of alternate proposals recommended by 2007-08 LPTAB at August 2007 meeting.]*

EvO5. Hire an experienced science teacher to provide feedback and assistance to Fellows who are determined to be "struggling" by the evaluation process *[NOTE: Implementation postponed due to lack of funding. Possible alternative implementations are under discussion with the 2007-08 LPTAB.]*

EvO6. Identify benchmark modules that would assist Fellows in the creation and design of new units of instruction

EvO7. Provide specific professional development to Fellows to help them counter some students' perceptions that STEM courses are not interesting *[NOTE: Implementation postponed till summer 2008 at earliest]*

EvO8. Establish a more streamlined process for Fellows to bring technology into the classroom

EvO9. Program staff should consider what sources (faculty, teachers, peers, others) of support and encouragement they anticipate for Fellows and adjust program expectations and professional development accordingly

EvO10. Have all Fellows and teachers paired early enough in the summer to permit them time to get to know one another, plan together and lay out a schedule before the school year begins *[NOTE: Program staff has observed that historically implementation is generally limited by participating teachers' availability and contactibility during summer months]*

EvO11. Have each cooperating teacher complete an evaluation of the Fellows' teaching and lessons. This should be completed relatively early in the placement. In turn, have each Fellow complete an evaluation of his/her cooperating teacher. This evaluation should focus on mentoring, in-class support, and other needs the Fellow has of the cooperating teacher

EvO12. Require all new Fellows to observe with experienced fellows for at least 4 weeks before beginning with a teacher *[NOTE: As all 2007-08 fellows were 2006-07 fellows, no immediate action was taken. Program staff foresees difficulty in implementation at stated given current July 1-June 30 fellowship cycle, rendering problematic any obligation requiring 4 weeks during the period prior to the start of a fellowship. Program staff is working with the LPTAB to resolve the issue.]*

EvO13. Provide each new (and returning) Fellow with a packet of materials on designing and delivering effective science education *[NOTE: This has not yet been implemented; discussion with the Lead Teacher Advisory Board is planned for spring 2008.]*

EvO14. Find ways to include the cooperating teachers more directly with the Fellows and the program/University. *[NOTE: This recommendation is under discussion between program staff and LPTAB throughout 2007-08.]*

EvO15. Ensure the consistency of implementation with some type of monitoring system. This could be random sample of classes that will be observed, or some other evaluation method *[NOTE: Due to cost overruns for 2006-07 evaluation activities and reduced monies available to 2007-08 evaluation activities, this objective will not be implemented in the foreseeable future.]*

I.B.1.2 Summary of how 2006-07activities have helped project meet short and long-term goals and objectives.

Initial 2005-06 Program Evaluation findings were presented to program staff during the fall of 2006. Fellows-only meetings (EVO3) also began during the fall of 2006, before formal evaluation recommendations were made in February 2007. Fellows have since been charged with assisting program staff to meet EvO2, EvO8 and EvO13 by generating proposals for implementation during the 2007-08 academic year. A module template has been designed to provide initial assistance in module design (EvO6). Implementation of most of the remaining objectives began in the summer 2007 with the institution of a Lead Participating Teacher Advisory Board (LPTAB). For each participating school district, a lead teacher was selected. These teachers act as liaisons between their school district and the program, interfacing with school administration and department heads, coaching Fellows (particularly new Fellows) and new teachers. LPTAB members also serve on the selection committee for new Fellows and assist in identifying teachers at lower grade levels to participate. Lead teachers assist in determining merit pay for cooperating teachers, assist program staff in understanding the needs for materials and in the delivery of a

summer workshop on how to design and implement effective science instruction, meet periodically with program staff, school guidance counselors and principals to discuss program implementation and attend bi-monthly meetings to discuss issues with other lead teachers and program staff.

The LPTAB is working with program staff to deploy EvO1, EvO2, EvO4, EvO5, EvO6, EvO7, EvO8, EvO9, EvO12, EvO13, EvO14. EvO1 had its initial implementation in an October 2007 letter of self-introduction of the GK-12 Sensors! program with an announcement of selection of 2007-08 lead teachers to all participating school administrations, school boards, and guidance personnel. The letter included offers to speak with all stakeholders (including e.g. parent-teacher associations) of the value the program brings to students, parents, teachers and schools, and to work with guidance counselors to explore mechanisms for making personnel and/or resources available to students considering science and engineering career paths.

2006-07 activities generally supporting Track II long-term program goals and objectives include

- Intensification of GK-12 Sensors! integration into middle and high school curricula by transitioning 2007 RET participants into the 2007-2008 GK-12 Sensors! program
- Year two of 'Introduction to GIS' in the BHS geography curriculum: 'Introduction to GIS' is a hands-on, inquiry-based course offered as a year-long advanced geography course, developed in part in response to strongly positive feedback from students involved in other GIS-based inquiry-learning projects GK-12 Sensors! fellows have facilitated at BHS
- Further development of teaching modules created by teachers and fellows and fellow-lead redesign of modules informed in part by program interactions with teachengineering.com, a national library of engineering related learning modules for grades K-8
- Exploration of potential partnerships with the Maine Mathematics and Science Alliance (http://www.mmsa.org/) to make all GK-12 Sensors! learning modules readily available to all Maine (and New England) STEM educators
- Institutionalization of focus groups as a component of the evaluation program
- Strengthening of links between collaborating schools and UM by coordinating guided tours of on-campus research facilities
    - April 4, 2007, Fellow French and HHS participating teacher Meyer bring physics classes to tour UM Laboratory for Surface Science and Technology (LASST) facilities
    - April 13, 2007, Fellow Kennard and ESH participating teacher and 2006 RET Dayton bring Dayton's students on a field trip tour of UM research facilities LASST and Advanced Engineering Woods Composites (AEWC) Center
    - June 1, 2007, Fellow Wark and OTHS participating teacher and 2006 RET Ploch bring honors biology students to UM to tour LASST
    - November 6, 2007, Fellow Clark and BuHS participating teacher Denise Smith facilitate tours for BuHS biology students of Scanning Electron Microscopes (SEMs) in UM Geology, Biology and Chemical & Biological Engineering departments
- Community Outreach
    - Fellow Doore, BHS participating teacher Chernosky and students of the BHS GIS Class complete Crime unit designed using data from Bangor Police Department and present findings and crime-data tracking system to Bangor Police Department Assistant Police Chief Peter Arno (June 12, 2007)
    - Fellows Kennard and Mahaffey and UM Assoc. Dean of Eng. Rock give visiting-professional presentations to students attending the Ellsworth High School Career Fair (June 12, 2007)
    - Fellow Shareef volunteers as instructor at the Summer Junior Engineering and Mathematics Program, Eva Szillery, director (June 18-22, 2007)
    - 'Bangor Daily News' publishes GIS maps developed by BHS GIS class for BDN article 'Let's celebrate Asia' (Nov. 16, 2007)
    - Fellow participation in Fall 2007 after-school programs: Fellow Shareef assists with EHS participating teacher Marti Dayton's EHS Young Engineers Club and attends Geek Squad meeting at JFCS directed by participating teacher Tracy Vassiliev; Fellow Mahaffey organizes 'BLUE Fish Group,' a weekly after-school activity for IIS seventh grade students interested in setup and maintenance of a classroom aquarium for science credit

  - Fellows Bolton, McCann and Spratt participate as organizers and/or judges in science and invention fairs at DMS, CoMS. RBMS, BrMS during the spring of 2007
- Program-related conference participation
  - PI John Vetelino, Program Evaluator Brian Doore and Program Coordinator Joe Arsenault present a poster titled '2006-07 University of Maine GK-12 Sensors!: Refining Program Implementation Through Multiple Methods of Evaluation,' at the GK-12 National Meeting, March 9-11, 2007, in Washington, DC.
  - Fellow Lester French provides overview of GK-12 Sensors! program at presentation given at the 'TWENTY-SEVENTH STATE-WIDE MEETING OF HIGH SCHOOL PHYSICS AND PHYSICAL SCIENCE TEACHERS,' March 16, 2007, University of Maine, Orono.
  - PI John Vetelino and Program Evaluator Brian Doore present 'Work in Progress: Evaluation of the University of Maine GK-12 Sensors! Program' at the 2007 Frontiers in Education conference, October 13, 2007, in Milwaukee, WI.
- GK-12 Fellows professional research contributions (supported in part by program)
  - May 13-16, 2007—Fellow Kennard attends presents research in 'Single Molecule Imaging Spectroscopy of Mesoporous Silica Membranes' at North American Membrane Society annual meeting, Orlando, FL.
  - June 10-14, 2007—Fellow French gives research poster presentation at Transducers '07 & Eurosensors XXI in Lyon, France.
  - July 28-31, 2007—Fellow Bolton presents research in poster 'A non-invasive vitality sensor for the American Lobster (Homarus americanus)' at the Institute of Food Technologist Foodsmarts: IFT 2007 Annual Meeting & Food Expo, Chicago, IL.
  - September 25, 2007—Fellow Bolton presents research in 'A non-invasive vitality sensor for the American Lobster (Homarus americanus)' at the 8th International Conference and Workshop on Lobster Biology, Charlottetown, Prince Edward Island.
  - October 3, 2007—Former fellow Nagy presents research poster titled 'Using a Lattice Model to Examine Fracture Energy in Red Spruce' at the Wood-Based Composites Center Fall 2007 Industry Advisory Board Meeting, UM, Orono.
  - October 29, 2007—Fellow McCann presents oral report on research in 'Lateral Field Excited High Frequency Bulk Acoustic Wave Sensors' at the 2007 IEEE International Ultrasonics Symposium, New York, NY.
  - October 31, 2007—Fellow Wark presents poster and oral report on research in 'A Lateral Field Excited Acoustic Wave Sensor for the Detection of Saxitoxin in Water' at the 2007 IEEE International Ultrasonics Symposium, New York, NY (received Best Student Paper).
  - November 8, 2007—Fellow Clark reports on research in 'Correlation of Microhotplate Metal Oxide Sensor Response to Catalytic Fluorocarbon Decomposition Activity' at the American Institute of Chemical Engineers' 2007 AIChE Annual Meeting, November 4th-9th, 2007, Salt Palace Convention Center, Salt Lake City, Utah.

I.B.1.3 General description of 2006-07 project activities and involvement of fellows, teachers and institutions.

During the 2007-08 reporting period, GK-12 Sensors! has continued its collaboration between an interdisciplinary team of University of Maine (UM) engineers and scientists working in sensors, six Maine high schools (Bangor High School [BHS], Brewer High School [BrHS], Bucksport High School [BuHS], Ellsworth High School [EHS], Hermon High School [HHS] and Old Town High School [OTHS]) and seven Maine middle schools (Brewer Middle School [BrMS], Bucksport Middle School [BuMS], Caravel Middle School [CaMS], Indian Island School [IIS], William S. Cohen School [CoMS], James F. Doughty School [DMS], and Reeds Brook Middle School [RBMS]). This year we have maintained our presence throughout grades 6-12 of participating school systems, leveraging the program's strong connections with Dr. Vetelino's UM-NSF RET: Sensors! Program, whose 2007 participants became 2007-08 GK-12 Sensors! participating teachers.

Fellow Jason Bolton works with 2004 RETs Trisha Bernhardt (DMS) and Tracy Vassiliev (CoMS, DMS) and 2005 RET Tim Surrette (CoMS) at DMS and CoMS. Fellow Aaron Clark works with 2005 RET Jennifer Skala of BuMS and 2004 RET John Mannette of BuHS. Fellow Stacy Doore works with

cooperating teacher Margaret Chernosky (Geography, GIS) at BHS. Fellow Lester French works with 2005 RET Richard Burger of CaMS, and 2005 RETs Joanna Lisker and Debra Merrill and 2006 RET Jeff Langevin of HHS. Fellow Raymond Kennard works with 2006 RET Marti Dayton of EHS. Fellow Christie Mahaffey works with 2006 RET Sue Wentworth at IIS. Fellow Don McCann works at RBMS with 6th grade teacher (2004 RET) Georgianna Piete, 7th grade life sciences teacher (2004 RET) Bob O'Leary and 8th grade science teacher Lori Matthews. Fellow Kristopher Sgambato works at BrHS with cooperating teachers Tia Achey, Todd Hillier and Darrell King. Fellow Ali Shareef works at BHS with cooperating teacher Don Erb (computer science). Fellow Kyle Spratt works with 2007 RET Frank Page at BrMS. Fellow Mitchell Wark works with 2006 RET David Ploch (biology) at OTHS.

I.B.1.3.a Training, workshops, seminars and/or professional development for fellows and teachers

At the August 2007 summer workshop, GK-12 Fellows, teachers from BHS, BrHS, BrMS, BuMS, BuHS, RBMS, EHS, HHS, IIS and OTHS, and faculty members from UM met at UM for a one-day workshop to report on summer 2007 RET research activities and formalize GK-12 Sensors! activities for the 2007-2008 academic year. The morning session involved members of the LPTAB. The afternoon session began with RET presentations of summer research. Fellow Mahaffey and participating teacher Wentworth reported their experience at the week-long Bowdoin College Coastal Science Institute (BCCSI) for Middle School Science Teachers (Mahaffey and Wentworth's participation was covered by the program). Thereafter, schedules and modules to be deployed for the 2007-2008 academic year were finalized between fellows and cooperating teachers

I.B.1.3.b Curriculum materials adopted or developed

On the basis of the success of learning module development in prior years, each fellow created new learning modules during the 2006-07 reporting period. These modules are designed to be easily ported from school to school. (Modules are available online at http://www.eece.maine.edu/research/gk12/hme.htm.)

I.B.2 Communication

I.B.2.a. Journals published

Doore, Brian. J. Arsenault, C. Holden, S. Godsoe, J. Vetelino, "Work in Progress: Evaluation of the University of Maine GK-12 Sensors! Program," Frontiers in Education "Proceedings of the 2007 Frontiers in Education Conference, Milwaukee, WI" (in press).

I.B.2.b. Books published: None.

I.B.2.c Newsletter and Newspaper articles

Taylor, Ted. "Seismic Survey Begins at Bangor High School", The Bangor Communiqué, Fall/Winter 2006-07, 6.

"BHS Geo Students Collaborate with Bangor Daily News for Publication," The Bangor Communiqué, Fall/Winter 2006-2007, 1.

"Race cars, popsicle stick bridges, boats help 7th grade science students learn Newton's laws of motion," What's Brewing in Brewer Schools, Feb. 2007, 13.

"NSF grant puts OTHS teacher into UMaine sensor research lab, brings grad student into OTHS science classrooms," Old Town Community Connections, Feb. 2007, 6.

"OTHS Honors Biology class visits LASST labs at UMaine," Old Town Community Connections, Aug. 2007, 7.

Lahti, Sue. "Let's celebrate Asia," Bangor Daily News, November 16, 2007: C2-3.

Haskell, Meg. "Forgotten Bangor cemetery focus of researchers," Bangor Daily News, November 26, 2007, A1, A3.

Vassiliev, Tracy, Patricia Bernhardt, "James F. Doughty School Students Conduct a Scientific Investigation of Invasive Crab Species at Moose Point State Park," The Bangor Communiqué, Spring 2007, 9.

I.B.2.d. Website developed: http://www.eece.maine.edu/research/gk12/portablemodule.htm

II. External Evaluator's Report

GK-12 Sensors! Evaluation Report: 2006-2007 Abbreviated Evaluation Report

Prepared by: Brian E. Doore & Walter J. Harris, Center for Research and Evaluation, College of Education and Human Development, University of Maine, July 31, 2007

Section 1: Evaluation Design

Pre- and post- program surveys of participants (Fellows, K-12 teachers, K-12 students, University faculty) attitudes were conducted during the 2006-2007 academic year, and a follow up focus group was conducted with the Fellows in April of 2007 to determine the fidelity and effectiveness of program implementation. Each questionnaire consisted of selected (Likert scale) and constructed response questions aligned to the stated grant objectives. In addition, respondents were provided multiple opportunities to give extended verbal and written responses reflecting their impressions of various aspects of the GK-12 experience. Questionnaires were administered at the beginning of the school year and again in May of 2007. The Fellows were also observed teaching in their classrooms. Their lessons were rated using Horizon Research's "Inside the Classroom" protocol. These observations were aggregated across Fellows to identify specific areas of strengths and needs for the program to consider. No individual Fellows are identified in this report.

The results of these evaluation activities are by nature qualitative – any attempt to generalize the meaning of the frequencies, percentages or differences is both unwise and inaccurate. Instead, the pattern of comments and responses must be considered in their totality and interpreted as the opinions and perceptions of the responding individuals only.

A note about this evaluation: At the client's request, this evaluation focuses on those aspects of the program that might be changed to further improve the impact of GK-12 on the schools, teachers, and most importantly students touched by this project. This abbreviated report does not clearly communicate the extent to which this program has made substantial and important impacts on these audiences. The evaluator commends the program staff on their interest in continuous improvement, and desire for critical feedback. As such, this report includes a large number of recommendations based on potential needs identified during the course of the evaluation activities.

Section 2: Overview of significant findings:

Student Surveys Middle School: Fellows' classes were surveyed in the fall of 2006 and the spring of 2007 to determine the impact of the GK-12 program on students' interest in STEM, and future aspirations to study STEM at the college level. A total of 173 middle school students completed the pre- and post-questionnaires.

The responding students were enrolled in sixth through eighth grade, with a handful of respondents enrolled in other grades. Most respondents (70%) indicated they planned to attend college, and 19% indicated they intended to pursue an advanced degree. When asked whether they would like to study STEM in college, 41% indicated they would, 28% would not, and 30% were not sure. Interestingly, over 85% of these respondents expected to do *Well* or *Very well* in the STEM courses they were enrolled in. Program staff may want to consider this gap between perceived ability to perform in STEM courses and students' interest in taking them in the future. Part of the answer may lie in participants' feelings about STEM courses. Only 28% of responding students said STEM courses were their *favorites*, while 55% said they were *OK, not my favorite,* and 17% expressed a general dislike of STEM courses. Program staff may want to provide specific professional development to Fellows to help them counter these students' perceptions.

Students were very positive about the degree of impact the Fellows had on them personally. Approximately 60% of responding students indicated they became more confident in their STEM class because of the GK-12 Fellow while only 1.2 % suggested they were *less* confident. Another 55% said they liked the class more because of the GK-12 Fellow, while only 7% said they liked the class *less*.

Student Surveys High School: A survey similar to the one described in the preceding section was given to high school students enrolled in STEM courses taught by GK-12 Fellows. A total of 158 high school students returned the questionnaire. The pattern of results on this survey is strikingly similar to those on the middle school survey. The high school students exhibited similar levels of interest in attending college. Slightly over 80% of respondents indicated they planned to complete at least 2 years of college, and

approximately 75% intended to complete at least a 4-year degree. Encouragingly, almost 30% of responding students said they wanted to complete an advanced degree. Also encouraging was the proportion (44%) of students interested in studying STEM as their major in college. Both sets of numbers were up slightly from the proportions found in the middle school survey. Paradoxically, when asked if STEM courses were their favorites in school, only 29% of respondents indicated they were.

Similar to the middle school students, the high school respondents were very positive about the presence of the GK-12 Fellows in their classes. A majority of students (89%) said the Fellows were *Quite helpful* or *Very helpful* in helping them learn the material for their STEM class. Only 7% of responding students indicated the Fellows were *Not helpful* in this respect. This same pattern was also true when students were asked about how the Fellows' presence impacted their confidence in learning STEM. On this question, 62% of responding students indicated their confidence had increased because of the Fellow, while only three students (1.8%) said their confidence had *decreased*.

The final two questions on the high school survey asked students to rate the degree to which their interest in their specific class and in STEM had changed as a result of the GK-12 Fellow working with their teacher. Over half of all responding students (53%) felt they liked their class more because of the Fellow, 26% already liked the class a lot, and 14% never liked the class. Only 6% of responding students suggested they liked the class *Less* because of the GK-12 Fellow. When asked to comment on how the Fellow had impacted their interest in STEM in general, most students (76%) were more interested in STEM because of the Fellow. This includes 27% of responding students who indicated they were *always interested in getting more STEM.*

In sum, students—whether middle or high school—were positive about the presence of the GK-12 Fellows in their classes. They indicated these graduate students had increased their knowledge in their classes, increased their interest in their classes, and made them more likely to study STEM in the future.

Teacher Surveys: Teachers were surveyed in the fall of 2006 and again in May of 2007 and several of the questions from the fall survey were repeated to detect shifts in participants' attitudes and perceptions. When asked how difficult it was to supervise the Fellow(s), all responding teachers indicated it took *Little* to *No time and effort*. Most (90%) of responding teachers felt the program would improve their teaching effectiveness, and eight (80%) indicated the program would assist them to some degree in aligning their curriculum to state standards. Similarly, eight (80%) of responding teachers said their involvement would help them further integrate technology into their classrooms. Three respondents (30%) suggested the presence of the Fellows would *Greatly improve* the motivation of their students to study STEM, and another six (60%) indicated it would *Somewhat improve* their students' motivation. Finally, when teachers were asked to characterize their overall experience with the GK-12 program, nine of the ten responding teachers said it was a *rewarding* experience. Only one teacher indicated it was *neither rewarding nor disappointing*, and no respondents said it was a *disappointing* experience.

When teachers were asked to write about their experiences with the GK-12 Fellows, they shared many positive experiences. Several teachers wrote at length about the positive difference the Fellow had made for students in their classes. Other respondents mentioned the quality of the instruction and ideas the Fellow brought with them. Still other respondents referred back to the positive summer research experiences they had. One respondent was not positive about the program, and indicated the only benefit received was the stipend. This response is not in agreement with the majority of teachers' perceptions, but signals a potential breakdown in communication, conflict, or issue to be resolved.

Fellow Surveys: Fellows were asked to comment on their overall experience with the GK-12 program. All but one of the respondents indicated it had been a rewarding experience for them. This finding is important in light of the constructive criticism provided by responding participants in other parts of this survey. While participants pointed out specific needs the program should address, they were overwhelmingly positive about their experiences working with teachers and students and felt they had gained a great deal from the experience. The results of both the spring focus group as well as the comments on the qualitative portions of this survey shows this pattern clearly – Fellows have specific suggestions to improve things, but overall, they have found the experience very satisfying and rewarding.

Fellow Focus Groups: In the fall of 2006 and the spring of 2007 GK-12 Fellows met together with the evaluator to discuss the implementation of the program, as well as the Fellows' perceptions of its effectiveness. The each of these meetings began by asking the Fellows to comment on how things were

going in general. In both meetings, the Fellows were positive about their placements, their studies and the program in general. Next, the Fellows were asked to comment on specific elements of the GK-12 program. When asked about the communication from the program staff, Fellows noted the frequency, timing, and quality of the communication were much improved over past years of the program. On a related point, they also appreciated having a manual to help guide them.

While Fellows recognized improved communication directed towards them, they simultaneously identified a need for improved communication with the participating schools. In particular, several responding Fellows mentioned communication between the GK12 leadership and the administration of the schools in which they worked. One Fellow commented:

> It would probably be nice, a technicality, but it might be nice for the program to write to the [school] administration saying you know this is what we're hoping will happen and we appreciate your cooperation and that sort of thing and the hope is that the school's are benefiting from us but it's also nice to do the polite protocol and we're hoping to be here, thank you for your cooperation. My teacher also recommended as the end of the year's approaching it might be nice to receive a letter from the PI's of GK-12 to write to the school board, saying thank you so much for having us this year, we hope to continue again with a few technicalities, thank you can go a long way.

Another area of concern was the schedule of working in schools. While all Fellows indicated the usefulness of the program to them – both in terms of the experience and the rumination – all respondents said being in the schools was slowing their research. One suggestion to address this concern was to have Fellows follow the University schedule of classes. According to the responding Fellow; this would permit the Fellows to focus on their research in May and June instead of continuing to go into classrooms.

Fellows commented on the value of meeting regularly with the RET's during the summer of 2006. One Fellow noted:

> I'll just say the summer meetings were good. They were good for me.

Another Fellow said:

> I am willing to bet that this summer (of 2006) was really good for the new RET's and the new Fellows, because obviously in the years past, we haven't done that type of thing. I wish something like that had happened when I was a first year Fellow.

Several Fellows talked about the bi-weekly journals they submit to the program manager. Some Fellows expressed frustration over a lack of feedback on these submissions. Similar to statements made in the April 2006 meeting, Fellows wished for some feedback on these submissions. For a few of the Fellows, it was unclear whether the program staff read their submissions. Other Fellows thought the program manager read them, but probably not the PI's.

> …one of the comments I've made is of feedback indicating that our stuff has been read would be nice. And I've made that comment last year, and by golly, I've gotten some feedback. Joe normally sends me a little note now. I don't know if he does it for the rest of you.

In addition to talking about the administration of the program, Fellows discussed their experiences working with teachers. Their comments can be categorized under three broad categories: relationship building, content, and timing. While all Fellows felt they had developed a good working relationship with their cooperating teachers, some Fellows clearly had a more personal connection to their teachers than others. Perhaps not coincidentally, it was these same Fellows who demonstrated the highest levels of performance in the classroom when they were observed in the fall and spring. The following comment reflects some of the complexity Fellows face going into schools:

> But, I think a lot of it depends on the school and teacher…like what I've heard from _____, s/he and his teacher are working very closely together it seems like everyday. The teacher I was assigned to, he's…somewhat dependent on the subject, too, so there's less room for me there. So, when I can't be in his class, my options are either find another class or do nothing. And so…I'm trying to…my first other step is other earth sciences classes and trying to take some of the stuff I do in _____'s class and do in the other classroom, since it's…it requires less time…you get more bang for the buck…less prep time.

In the subsequent discussion, the Fellows discussed the broad variety of ways they worked with teachers: from working solely with one teacher to working with several teachers spread across multiple school districts. The importance of this variety goes beyond describing the number of teachers or classes the Fellow works with – it also directly impacts the way the Fellows are interacting with students. In the classroom observation section, Fellows' lessons are described in detail. Some Fellows follow closely with the curriculum of the teacher, while others (like the Fellow above) go to classes to do a "special" activity. These activities are often only loosely related to the students' current unit of instruction. As a result, students who come into contact with GK-12 Fellows have very different experiences – some find Fellows an integrated part of their classroom, while others experience a "guest presenter." This evaluation does not cast value judgments on either approach, but stresses the differences each may have on students' learning and motivation.

<u>Recommendations:</u>

- *Interview students who have experienced each type of Fellow placement, then analyze the kinds of impacts these students describe*
- *Consider a compromise position between the schools' schedule and the University's schedule*
- *Institute a regular form of communication between the program and the schools. This might be vis-à-vis the lead teachers, but might also include a direct contact between the PI's and the schools' administration in the form of a welcome/appreciation letter*

Classroom Observations: For the UMaine GK-12 classroom observations, two systematic observation techniques were employed. First, each Fellow was observed using an observation protocol developed by Horizon Research for NSF to evaluate highly effective science instruction. The second tool used was a time sample analysis. One interesting note is that most of the advanced classes were primarily made up of females. General science classes tended to be more evenly split. One example is an honors Biology course: 83% Female, 17% Male. Another is Honors Calculus 67% Female, 33% Male. Finally, one basic general Science course had 50% Females and 50% Males.

Instructional Focus of the Lesson: Most of the time, Fellows focused on the broad concepts in Science, with little focus on teaching specific skills. Still, a substantial amount of Fellows' time was spent teaching facts, vocabulary and algorithms. These tended to manifest themselves as worksheet activities, or other basic direct learning activities. For these lessons, there was no experiment or demonstration and usually no lab/inquiry experience. There seemed to be some movement towards concepts in the spring 2007 observations.

Content Focus of the Lesson: Classrooms were rated on several characteristics of the lesson, including organization, content, active learning, alignment to goals, "sensemaking" and wrap-up. There are several possible trends that warrant attention. First, the apparent amount of preparation was not consistently high. In fact, using the descriptors in the NSF protocol as a guide, only 2 of the 11 observations reached this standard. In some cases, materials were not ready; in others the Fellow was not prepared to talk about the topic or was unsure of what the next step in the activity was.

Another area of concern was the degree of connectedness with prior learning. In many cases, Fellows began a lesson with no link to students' prior knowledge. For one lesson, the Fellow asked the students: "so you have covered this before, right?" The Fellow didn't wait to find out the answer. Instead, the next phrase was "excellent, so given what you know about X, you can see how it applies to the solution to this problem." This was a typical pattern for those lessons where Fellows failed to make an adequate link to students' existing knowledge and experience.

A final area of concern is the amount of time Fellows dedicate to summary and wrap up activities. NSF refers to these as "sensemaking" activities. Perhaps not surprisingly, Fellows planned too much material for too little time. The result in several lessons was no time remaining to discuss the importance, or even what happened in an experiment. In fact, there were only two lessons where the Fellow conducted an inquiry based lab activity *and* left enough time to process what happened with the students afterwards. For a regular classroom teacher this processing can happen the next day. Because most Fellows are in the classroom sporadically, it is much more important for them to bring closure and meaning their activities the day they do them. Unlike the content focus, this area did not improve significantly from the fall to the spring.

This is not to say that there were not positive indicators in the observed lessons. On the contrary, Fellows did a solid job of using resources, creating an open learning environment and working collaboratively with students. In fact, Fellows really shined at working directly with the students in a respectful, inviting manner. Almost all of the Fellows had a comfortable, friendly and engaging style that promoted their connections to the students.

The lesson synthesis rating of 2.91 in the fall and 3.08 in the spring reflects this mixed performance. The work of the Fellows was mixed in delivering science education using the best practices as defined by this protocol. Addressing the concerns mentioned above would substantially improve design of these lessons. Unless the Fellows systematically plan to incorporate best practices in science education, they are not likely to deliver them during instruction.

Instruction and Delivery: Implementation refers to the ways that the Fellows delivered their instruction including teacher confidence, verbal interaction, questioning strategies and classroom management. Taken

together, these are the qualities that make a teacher effective "in the moment" of teaching. The results for the GK-12 Fellows in this area were mixed. Some of the Fellows had an effective delivery of the lesson, used appropriate questioning techniques, checked for student understanding and proceeded at a pace that worked for the students. Other Fellows did not have these skills. An examination of the raw data supports this conclusion also – those Fellows with high rankings in one area have high rankings in all areas. Conversely, Fellows who scored low tended to score low in all areas. This variation in instructional delivery is expected for a one-time observation. Still, as an experienced observer of teachers and classrooms, the discrepancies between the best teaching observed and the worst cannot be explained solely due to random differences on the day of the observation. Clearly, there are real differences in the Fellows' teaching skills.

Quality Indicators for Math/Science: The next area addressed on the systematic protocol was a set quality indicators for the Mathematics/Science content of the target lesson. The quality indicators included ratings of the appropriateness and worth of the lesson as well as the accuracy of the Fellow's instruction. This area also addressed the use of abstraction when teaching concepts, as well as the explicit links made to other disciplines and real world applications. Somewhat surprisingly, many Fellows did not adequately meet these goals during this set of observations. In some cases, lessons were not rated highly for scientific significance because those lessons were activities that were unconnected to theory. For example, when an activity is introduced that requires students to build a bridge, but there is little to no lead in for that activity in terms of design, shapes or characteristics of strong structures; it's difficult to imagine that students can spontaneously make those connections on their own. In some cases the Fellow had done a review on a previous day, but during the course of the activity, many opportunities to extend student learning were missed. This "missed opportunity" is reflected in the following scenario: (adapted from one fall 2006 observation.)

Students had completed building a bridge and then tried to test it. Upon testing it, the bridge failed. When the Fellow came over to the group to talk to them about what happened, the Fellow suggested: "why don't you try another design?" By itself, this is an appropriate response, but when taken in context of the whole lesson, the problem is clarified. The Fellow in this case was moving very quickly from group to group to check on progress. He spent a few seconds with each group before moving on the next. Questioning strategies were not used, and the students were not asked to reflect on why their bridge may have failed (or worked). At the end of the lesson, time ran out, and there was no discussion about why some groups structures failed and others succeeded. Compounding the problems in this lesson, the regular teacher was focusing on a different unit altogether. The bridge activity mentioned in this case happened right in the middle of a unit on cellular biology. Further attention will be paid to this issue later in this report.

Other areas for this portion of the observation showed similar variability across the Fellows' classes. Two areas of strength for the Fellows were the accuracy of their content and their displayed understanding of the material presented. While the observer is by no means an expert in Science, it is important to remember that the students in the class are not either. With regards to accuracy and comfort, most Fellows performed very well. When talking about their own areas of study, Fellows talked easily and comfortably. They also spoke with considerable authority on the topic, and were able to offer abstractions and elaboration easily and convincingly. The only issue was the consistency with which they did these things during this set of observations.

The synthesis rating of 2.9 (SD=1.2) in the fall and 3.08 (SD=.92) in the spring clearly shows the variability of the Fellows' performance in instruction.

Classroom Culture: The next portion of the Horizon protocol evaluated the Classroom Culture of the observed lessons. This part of the observation protocol focused on characteristics such as participation, respect, cooperation and intellectual rigor. This is an area where the Fellows performed particularly well. Consistently, Fellows delivered lessons that got the students directly involved in the learning. Only in a few cases were the students engaged in passive learning. The design of the lesson/activity was such that most students were directly involved in the learning process. This is something that rarely happens in teacher led activities. The overall ranking of 3.29 in the fall and 3.46 in the spring for this area, coupled with a smaller standard deviation further demonstrates the high quality classroom culture promoted by the Fellows.

While this is an area of relative strength for the group as a whole, there were some exceptions. In one case, the Fellow did not recognize the extent of student off task behavior. During one portion of the activity, one student was putting on makeup, another was on the cell phone and a third was surfing the internet. These student behaviors distracted those students who were attempting to follow the lesson. When the Fellow recognized the behaviors there was no adequate response. In the observer's opinion, this has to

do with a lack of experience working with students, and little practice with instruction. This is a theme that was repeated in many of the lessons observed, and manifested itself in a variety of ways.

Use of Instructional Time: Two things stand out with regards to instructional time. The first is how little instructional time is actually available to Fellows in the classroom. The second is the importance of careful planning to use that time wisely. The very large standard deviation demonstrates the large amount of variation in how Fellows used class time. In some cases, virtually no time at all was wasted in non-instructional time. For other lessons, a *majority* of the time was spent performing housekeeping, behavioral, set up, or other non-instructional activities. Equipment problems were particularly troublesome in several observations. In one case, fully one-half of the instructional period was spent setting up and troubleshooting equipment. The result in this case were the behaviors mentioned above – cell phone usage and internet surfing. To be clear, this was *not* the normal pattern for the Fellows. Most lessons started right away, and most Fellows made good use of the instructional period. In general, the Fellows who made the best use of time also had the highest rankings in other areas. These examples are mentioned, not because they were typical, but rather to show the consequences of poor planning and inattention to effective use of time.

Impact of Instruction on Student Learning: These rankings are among the most subjective of all the rankings on this protocol. Given this caveat, these overall rankings reinforce the pattern of rankings in the previous sections of this report. In general, the *perceived* impact on students understanding, capacity, ability and interest was positive. The pattern that has emerged in each section of this report is repeated again here. The Fellows who made good use of time, instruction and content probably had the most positive impact on students. It is impossible to judge whether these conclusions are valid, but visible indications of student interest and motivation seemed to index well with high rankings in these other areas. For example, lessons that began briskly, had substantial content, and had time for questions and clarification appeared to have more students who were directly engaged in the activity and the discussion. Lessons lacking in one or more of those features had fewer students exhibiting these behaviors. This informal observation has important implications for program review and implementation as discussed in the final section of this report.

Not surprisingly, no Fellows provided Level 4 or Level 5 instruction as defined by the capsule rating of the quality of the lesson. According to the standards set forth by the descriptors in the observation protocol, these levels are reserved for highly integrated, reflective, inquiry based instruction. The GK-12 Fellows came close to the characteristics described in Level 4, but none met that standard during these observations. The upper levels of this instructional rubric require that a Fellow do all parts of the lesson very well. In some cases, the Fellow was prevented from getting these scores because they failed to reach a certain subset of students in the classroom. In other cases, the time off task was too detrimental to the overall impact of the lesson. Finally, some lessons might have been exemplary had they incorporated sufficient levels of "sensemaking" and wrap up.

Time Sample Analysis: In addition to the structured observation protocol a time sample analysis was conducted in each of the classrooms. During the time sample analysis, 4 students were selected at random (by choosing 4 desks/seats before the start of class). These students were then observed once a minute for 15 minutes. In some cases, several time sample analyses were conducted during a single class section. The time sample analysis captures students' behaviors at regular intervals of time. For example, imagine four students sitting in four corners of a classroom. At 1m 0sec Student 1 is observed. That student is then rated as one of the following: *actively off task, passively off task, passively on task, actively on task.*

These are not precise measurements. A student who is looking out the window may very well be paying attention, while a student who is looking at the teacher may not be attending at all. Presumably, these two conditions will cancel each other out, and the pattern of results across all Fellows will provide some insight about when students are attending and when they are not. Anecdotally, the results seem to suggest three patterns. First, the time of day seems to be predictive of student attention. Second, gender appears to be related to time on task with girls attending more often than boys. Third, cooperative learning / inquiry based activities seem to be associated with a substantially higher rate of student on-task behaviors.

Section 3: Conclusions

The recommendations in this report are suggestions based on direct observations of Fellow's classrooms, as well as anecdotal evidence from Fellow and teacher focus groups. These results are by no

means exhaustive, and they are susceptible to rater bias. Despite these limitations, it is important to note that Fellows were warned in advance when they would be observed, and in most cases set the day of the observation at their convenience. Presumably, these results are a best reflection of Fellows' activities in local classrooms. If anything, they likely reflect an *overestimation* of the success of the Fellows. Additionally, these are baseline measures for many of the Fellows with little or no prior teaching experience. While some gains between fall and spring were apparent, the spring observation results suggest there remain areas in need of significant improvement.

These differences in implementation should not be interpreted as the failure of some Fellows and the success of others, but might instead be attributed to a four broad factors that contribute to the success of a Fellow. These are: access to materials, teacher mentoring, teacher cooperation, and Fellows' "independent learning" of best teaching practices. Together, these elements facilitate the success (or explain the difficulties) of a GK-12 Fellow.

Finally, these data suggest the impact the GK-12 program has had on teachers, Fellows, and classroom students. While this is a strong program, there are a number of specific strategies that may be considered for further improvement. A list of these recommendations and suggestions follow in the next section.

Section 4: Recommendations:

The first area, access to materials, can be greatly impacted by the GK-12 program. Some ways the program could support Fellows' access to materials are to:

- Create a repository of shared materials and lessons that all Fellows can access. Currently, Fellows report access to previous Fellows' modules is limited, and finding equipment and supplies is even more difficult. Some Fellows have found their own access to equipment, and if appropriate these should be shared with other Fellows.
- Create a database of materials and personnel around the campus, and across the participating schools, who have agreed to be available to assist the GK-12 Fellows and K-12 students. This is something the Fellows have mentioned a number of times in Focus group settings. Currently, Fellows report using a "lot" of time tracking down and securing the things they need to complete their modules.

The second area, teacher mentoring, and the third area, teacher cooperation are addressed together. During the course of the observations as well as the Fellow and Teacher focus groups, a single theme emerged – "fit." By "fit" the participants were talking about the complicated relationship between Fellow and cooperating teacher. In that relationship, Fellows and teachers had to broker a number of things including:

- how much independence and freedom would the teacher give to the Fellow
- how much direct involvement would the teacher have in the planning of the Fellow's lesson
- what direct involvement would the teacher have during the Fellow's lesson
- what attention would the Fellow pay in "fitting" the lesson into the curriculum of the teacher
- what flexibility would the teacher provide the Fellow in determining what might be appropriate for their class
- what feedback would the teacher provide the Fellow in order for them to improve their effectiveness
- what scaffolding and support would the teacher provide to make the lesson more successful
- what assistance would the Fellow accept as a part of the process of mentoring

Two anecdotal examples help to clarify these issues.

In this classroom observation, the cooperating teacher sat and graded papers while the Fellow delivered the lesson to the students. The Fellow had considerable difficulties with the equipment used for the lesson that day and consumed a lot of instructional time with set up. The Fellow also failed to link to students prior knowledge. The Fellow did not ask the students to see if they knew how to solve a particular kind of problem, instead, he went on with the lesson without checking students' understanding. As a result it was a very difficult lesson for both the Fellow and the students with both parties becoming visibly affected in a negative way. The Fellow was sweating profusely because he knew things were not going well, and the students were off task and restless.

This particular example is unusual but illustrative because it showcases so many issues happening at once. In this situation the Fellow was inexperienced and possessed few "in the moment" teacher skills. He also was relatively unprepared to deliver the lesson as evidenced by the equipment not set up in advance, and equipment not prepared for the activity in advance. By the time all of the setup and adjustment were in place, a good deal of instructional time was lost. The reader might be led to believe this is the same lesson mentioned earlier in this report. It is not. Across a total of 11 lessons, 3 exhibited problems of this magnitude. What makes this example particularly troublesome is the inaction of the cooperating teacher.

The Fellow had inadequate skills and preparation to be sure, but the cooperating teacher did not provide assistance or guidance at any point during this lesson. That individual might have helped the Fellow check for student understanding, assist in the setup and troubleshooting of equipment or intervene with students who were off task. That did not happen in this class, but the next example shows the contrast of an effective Teacher/Fellow relationship.

In this observation, the Fellow had an activity that required the students to collect data. The weather was not cooperating and the original plan would not work under the circumstances. The Fellow began class after the cooperating teacher took care of the housekeeping (attendance etc.) The non-instruction lead-in to class took less than 3 minutes at which point the Fellow began the lesson. The introduction to that lesson included a review of the concept, checking for students' understanding and then laying out the sequence of events to complete the activity. Also highlighted was the goal of the lesson and what the Fellow expected for outcomes. During this introduction and review the cooperating teacher offered extending links to other projects the students had done, followed up with students that did not appear to understand, and addressed students' off task behaviors. During the activity, the Fellow had all of the materials laid out in order, and quickly distributed the items the students needed to complete the activity. Following this, students began to solve the problems and complete the activity. The cooperating teacher went from group to group checking for understanding and redirecting students who were not on task by helping them identify the next step they needed to complete. Finally, the students had completed the activity and the last 8 minutes of class were spent reviewing each groups' findings. In two cases the groups answers were wrong. The Fellow discussed with the class where they might have gone wrong. In less than a minute the class discussed this and offered a solution to the group. Following the lesson the Fellow and the teacher talked about what had gone well and where they felt the students were still falling short in their comprehension of the topic. The teacher planned to address those gaps in knowledge the following day as the Fellow's lesson was directly integrated into the unit the cooperating teacher was completing with the class.

This observation shows the effective dynamic between teacher and Fellow, and the obvious communication and planning that went into making this a successful lesson. Clearly, this Fellow had a highly developed set of "in the moment" skills, but this person also had made careful plans in advance of the lesson. The teacher, likewise, had planned the timing for this activity when it would most benefit the class. In addition the cooperating teacher purposefully integrated both the Fellow and the lesson into her curriculum and lesson planning. While it may not be possible for all Fellows' lessons to look like this second example, there are a number of steps the Program can take to increase the likelihood of this second outcome and avoid the first example.

Recommendations for improving Teacher/Fellow teams:

- Have all Fellows and teachers paired early enough in the summer to permit them time to get to know one another, plan together and lay out a schedule before the school year begins
- Have each cooperating teacher complete an evaluation of the Fellow's teaching and lessons. This should be completed relatively early in the placement
- Have each Fellow complete an evaluation of their cooperating teacher. This evaluation should focus on mentoring, in-class support, and other needs the Fellows has of the cooperating teacher
- Based on these documents and a discussion between the Fellow and the teacher, a set of goals should be established for both the Fellow and the cooperating teacher. These might be quite informal: for example, "Arrive at least 20 minutes before class is to start to ensure set-up is complete" or "stay in room during labs and activities to assist with groups" or "provide additional assistance with classroom management." A short list of areas in need of additional help or attention would serve to formalize the relationship between the teacher and the Fellow, and could serve to bridge gaps in the Fellow's skill sets
- Program staff would collect copies of these goal plans and monitor progress directly, and through an external evaluator
- Request a videotape of a lesson from each participant. This would give program staff the opportunity to see the kinds of lessons and activities delivered by Fellows in local classrooms.
- Tie continued Fellowship / cooperating teacher status to improvement on identified goals

Fellows "independent learning" is the fourth and final area on this report. The concept of "independent learning" is just that – independent and self-directed. Fellows' focus groups and survey responses suggest they must research unfamiliar topics and find information to deliver modules with content not readily familiar to them. Some, but not all, Fellows have applied this approach to learning about instructional practices. Clearly, the intent of the GK-12 program is not to prepare K-12 science teachers. At the same time, certain skills are required to be effective in the classroom. Having experience with ways to group students, design activities and deliver information are basic skills needed by Fellows to work in the public

school. During the observation, it was clear that Fellows had different levels of understanding of these instructional techniques.

Additional Comments and Suggestions:

In addition to the specific suggestions made above, a few other ideas may help the GK-12 program improve fidelity of implementation.

- Encourage Fellows to meet with students and ask them for feedback about their lessons. Fellows might learn a great deal about what to improve or change by taking this simple step
- Conduct a session between Fellows and all the PI's and discuss how many hours a week should be devoted to this work, and what specific areas the program staff feels the Fellows should focus on
- Identify workshops on teaching science to K-12 students that Fellows could participate in. For example, MMSA holds conferences each year. Fellows might benefit from attending one of these conferences
- Consider having Fellows stop their classroom teaching in May when UMaine's spring semester is over
- Try to focus fellows on just one or two teachers to prevent them from getting stretched too thin
- Consider re-establishing the Wednesday meeting structure used in the summer of 2007 where Fellows and teachers got together to discuss teaching science
- Clarify the program's expectations of Fellows during the summer
- Make meaningful and personal contact with the administration in each of the Fellows' schools
- Identify the roles for each of the PI's and communicate those roles in person with the Fellows

III. Collaborative Response Report

III.A. Response to recommendations, focusing on how to incorporate them into practice

A number of themes emerge from evaluation findings and recommendations: 1. Communication between program staff and other stakeholders needs to be strengthened; 2. Fellows need clearer guidelines, more pre-classroom training and better support and constructive feedback; 3. Expectations, requirements and stipends for Participating Teachers need to be clear. Incorporating specific recommendations into practice will involve significant interaction between program staff, fellows and lead teachers throughout 2008 and 2009. The PI is confident that programmatic responses addressing most of the recommendations in each identified area needing improvement (access to materials, teacher mentoring, teacher cooperation and independent fellow learning) can be achieved by dialogue to consensus. Before mid-June 2008, the PI and co-PIs will instruct the program coordinator as to how to clarify the program's expectations of Fellows during the summer. The PI will take under advisement the evaluator's recommendation to terminate Fellow-classroom teaching in May. The PI generally concurs with the recommendation of focusing fellows on just one or two teachers, but feels several veteran fellows are well able to manage a larger collection of teachers without spending excessive amounts of time in schools. Concerning the recommendation to re-establish the Wednesday meeting structure used in the summer of 2006 where Fellows and teachers got together to discuss teaching science, it should be noted that that structure relied on the availability of teachers participating in the RET-Sensors! and being paid for their time. Teachers not involved in the RET program were generally unavailable throughout the summer.

III.B. Timeframe for appropriate actions

Establishing clearer guidelines, more pre-classroom training and better support and constructive feedback for fellows is of particular moment, as the new fellowship cycle begins July 1 and almost certainly new graduate students will be awarded fellowships. These issues, which involve teacher mentoring of fellows as well as training and professional development of fellows to enable independent learning, must be addressed and resolved in sufficient time to ensure that fellows (especially new fellows) are ready to interact with teachers and classrooms at the start of the 2008-09 academic year, late August or early September. To implement recommendations for improving teacher/fellow teams, fellow-teachers pairings will be determined by mid-July (for new fellows, the appropriate lead teacher and an experienced "buddy" fellow will work with the new fellow to ensure that the fellow and assigned participating teacher get to know one another, plan together and determine a schedule before the school year begins). At the annual August GK-12 workshop, fellows and assigned teachers will be required to declare a set of goals (for both Fellow and teacher) that program staff and the external evaluator will use throughout the academic year to monitor progress. It will be emphasized at the meeting that continued Fellowship/cooperating teacher status beyond June 2009 will be tied to meeting improvement milestones on identified goals. Also during the August workshop, a session between Fellows, PI and co-PIs will be conducted at which is discussed the expectations of fellows (including how many hours a week should be devoted each GK-12 requirement), specific areas the program staff feels the Fellows should focus on, and where the roles for each of the PI's is identified and communicated in person with the Fellows.

Program staff will work with the program evaluator during the summer of 2008 to create appropriate evaluation rubrics for 1. Cooperating teachers to evaluate Fellow teaching and lessons and 2. Fellows to evaluate their cooperating teacher(s). These rubrics will be made available to teachers and fellows before November 2008 and shall be completed and returned to program staff no later than Thanksgiving school vacation. Fellows will be tasked bi-monthly to meet with students and ask them for feedback about their lessons. Fellows will be tasked to determine guidelines for these student-feedback sessions at Fellows-only meetings during the summer and fall of 2008. A videotape of a lesson from each Fellow will be due before January 1, 2009 and again before June 1, 2009. Meetings of the PI, co-PIs and fellows will be held in January 2009 and June 2009 to discuss the progress of program implementation and any concerns or issues.

During the summer of 2007, program staff will work with lead teachers and their administrators, to determine a reasonable schedule for making meaningful and personal contact with the administration in each of the Fellows' schools throughout the 2008-09 academic year.

Program staff will work with lead teachers throughout spring 2007 to identify workshops on teaching science to K-12 students that Fellows could participate in. The evaluation report notes that the MMSA [Maine Mathematics-Science Alliance] holds conferences each year and that "fellows might benefit from attending one of these conferences." Most of these conferences, though free, are restricted to particular cohorts. GK-12 Sensors! needs to discuss with MMSA program staff how to include fellows in its conference offerings.

Providing better access to materials and developing a database of material and expertise will be ongoing.

III.C. Discussion of project goals and measured outcomes and potential impact on issues surrounding sustainability

The program is seeking sustainability through state and institutional funding for fellowships. At the state level, the question of sustainability was addressed extensively in collaboration with two other GK-12 programs (UM, Brawley, PI; University of Southern Maine, Duboise). A bill was submitted to the legislature to obtain sustained funding. The measure was passed but no funds were allocated.

At the university level, sustainability is being addressed relative to EPSCOR funding. A mechanism for funding several GK-12 fellows through EPSCOR is currently under discussion.

Toward the program's goal of fostering long-term partnerships between schools, UM and community groups, GK-12 Sensors! is interacting with members of local schools and communities to determine (in partnership with UM) ways of allocating funds to create permanent Fellow positions at the schools. The positive impact on students, school curriculum and local communities already demonstrated by the GK-12 Sensors! program is key to the success of such partnerships. Program impact is proactively disseminated to the public via communiqués, newspaper articles and local television news broadcasts. Therefore schools and communities recognize the significant role GK-12 plays in the education of their children, which works to improve public perception of both the program and higher education, especially UM. Thus the PI is hopeful that, in concert with university, which seeks to increase enrollment, etc., schools and communities will agree to share in the support of GK-12 Fellow positions in local schools by the 2010 budget cycle. By involving parents, school committees and other members of the community in discussions of partnering with UM, the program also aims to encourage more and meaningful private sector engagement in Maine's public schools.