

Appendix A

Science Laboratory Environment Inventory

Your willingness to take part in this research is appreciated. The attached survey contains three components:

1. Science Laboratory Environment Inventory-Actual Form: This part of the survey is designed to ask you your opinion of the science laboratory activities and environment in your science classroom.
2. Science Laboratory Environment inventory- Preferred Form: This part of the survey asks for your perspective on what your ideal science laboratory activities and environment would be in an ideal situation.
3. Demographic information: This part of the survey contains questions regarding personal demographic information.

Your decision about whether or not to participate in this survey will not affect you in any way. All of the information provide here by your responses will be kept confidential.

Science Laboratory Environment Inventory (SLEI)

Directions

This questionnaire contains statements about practices that *could* take place in this class. You will be asked how often each practice *actually* takes place.

There are no “right” or “wrong” answers. Your opinion is what is wanted.

Think about how well each statement describes what your laboratory class is *actually like*. Draw a circle around

- | | | |
|---|---|--------------|
| 1 | if the practice <i>actually</i> takes place | ALMOST NEVER |
| 2 | if the practice <i>actually</i> takes place | SELDOM |
| 3 | if the practice <i>actually</i> takes place | SOMETIMES |
| 4 | if the practice <i>actually</i> takes place | OFTEN |
| 5 | if the practice <i>actually</i> takes place | VERY OFTEN |

Be sure to give an answer for all questions. If you change your mind about an answer, just cross it out and circle another.

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

Practice Example. Suppose that you were given the statement: “Students choose their partners for laboratory experiments.” You would need to decide whether you thought that students actually choose their partners “Almost Never,” “Seldom,” “Sometimes,” “Often,” or “Very Often.” For example, if you selected “Very Often,” you would circle the number 5 on your answer sheet.

Item	Almost Never	Seldom	Sometimes	Often	Very Often
1. Students in this laboratory class get along well as a group.	1	2	3	4	5
2. There is opportunity for students to pursue their own science interests in this laboratory class.	1	2	3	4	5
3. What we do in our regular science class is unrelated to our laboratory work.	1	2	3	4	5
4. Our laboratory class has clear rules to guide student activities.	1	2	3	4	5
5. The laboratory is crowded when we are doing experiments.	1	2	3	4	5
6. Students have little chance to get to know each other in this laboratory class.	1	2	3	4	5
7. In this laboratory class, we are required to design our own experiments to solve a given problem.	1	2	3	4	5
8. The laboratory work is unrelated to the topics that we are studying in our science class.	1	2	3	4	5
9. This laboratory class is rather informal and few rules are imposed.	1	2	3	4	5
10. The equipment and materials that students need for laboratory activities are readily available.	1	2	3	4	5
11. Members of this laboratory class help one another.	1	2	3	4	5
12. In our laboratory sessions, different students collect different data for the same problem.	1	2	3	4	5
13. Our regular science class work is integrated with laboratory activities.	1	2	3	4	5
14. Students are required to follow certain rules in the laboratory.	1	2	3	4	5

Item	Almost Never	Seldom	Sometimes	Often	Very Often
<i>Remember that you are being asked how often (almost never, seldom, sometimes, often, very often) that each of the following practices actually take place in this laboratory class.</i>					
15. Students are ashamed of the appearance of this laboratory.	1	2	3	4	5
16. Students in this laboratory class get to know each other well.	1	2	3	4	5
17. Students are allowed to go beyond the regular laboratory exercise and do some experimenting of their own.	1	2	3	4	5
18. We use the theory from our regular science class sessions during laboratory activities.	1	2	3	4	5
19. There is a recognized way of doing things safely in this laboratory.	1	2	3	4	5
20. Laboratory equipment is in poor working order.	1	2	3	4	5
21. Students are able to depend on each other for help during laboratory classes.	1	2	3	4	5
22. In our laboratory sessions, different students do different experiments.	1	2	3	4	5
23. The topics covered in regular science class work are quite different from topics dealt with in laboratory sessions.	1	2	3	4	5
24. There are few fixed rules for students to follow in laboratory sessions.	1	2	3	4	5
25. The laboratory is hot and stuffy.	1	2	3	4	5
26. It takes a long time to get to know everybody by his/her first name in this laboratory class.	1	2	3	4	5
27. In our laboratory sessions, the teacher/ instructor decides the best way to carry out the laboratory experiments.	1	2	3	4	5

Item	Almost Never	Seldom	Sometimes	Often	Very Often
<i>Remember that you are being asked how often (almost never, seldom, sometimes, often, very often) that each of the following practices actually take place in this laboratory class.</i>					
28. What we do in laboratory sessions helps us to understand the theory covered in regular science classes.	1	2	3	4	5
29. The teacher/ instructor outlines safety precautions before laboratory sessions commence.	1	2	3	4	5
30. The laboratory is an attractive place in which to work.	1	2	3	4	5
31. Students work cooperatively in laboratory sessions.	1	2	3	4	5
32. Students decide the best way to proceed during laboratory experiments.	1	2	3	4	5
33. Laboratory work and regular science class work are unrelated.	1	2	3	4	5
34. This laboratory class is run under clearer rules than other classes.	1	2	3	4	5
35. The laboratory has enough room for individual or group work.	1	2	3	4	5

Appendix B

Demographic Information Survey

Thank you for taking part in this survey. The information in this survey is for educational research purposes only.

You will not be identified in this research. The following characteristics are used for analysis and research only.

Your science grade will not be impacted in any way by your answers this survey. You may skip any items that you do not wish to answer. You may choose to discontinue your participation at any time.

Student ID Number:	Date:
School:	Science Teacher:
Class Period:	Grade in school: <input type="radio"/> 9 th <input type="radio"/> 10 th <input type="radio"/> 11 th <input type="radio"/> 12 th
Gender: <input type="radio"/> Male <input type="radio"/> Female	Ethnicity/ Race: <input type="radio"/> Asian <input type="radio"/> American Indian <input type="radio"/> Alaskan Native <input type="radio"/> African American <input type="radio"/> Black <input type="radio"/> Hispanic <input type="radio"/> Pacific Islander <input type="radio"/> White <input type="radio"/> Other _____(please describe)
Type of Class (for example Biology): _____	Length of class (for example 50 minutes, 90 minutes, etc): _____

Appendix C

Consent Forms

Introductory Letter to Parents

Dear Parent/Guardian,

Your child has been invited to participate in a study being conducted by the staff of the Partnership for Research & Education in Plants (PREP) project at Virginia Polytechnic Institute and State University (VPI). Current guidelines for VPI require that all minors who participate in such studies must obtain permission from their guardians. Please read the following information and sign below to give us permission to include your child in this study.

Your child's teacher is participating in a program to introduce scientific research to high school students, in partnership with the Fralin Biotechnology Center at VPI and Compass Consulting Group (CCG), an education evaluation group based in Durham, NC. The teacher is implementing one or more biology lessons in his/her classroom and, as part of this study, will be sharing plans and information about implementation. Our research is designed to evaluate the impact of this program on students' learning and understanding of biology and scientific research.

As part of this study, your child's biology class may be visited by educational evaluators from VPI or CCG. Your child may be asked to participate in a brief interview about what s/he is learning, and may be asked to share his/her science research project related to PREP. Your child may also be asked to complete a survey related to his/ her attitudes toward science. Students' work samples and email exchanges with scientists may also be requested. Webchats between scientists and students may also be observed by the evaluator or videotaped and reviewed at a later date. All videotapes will be used for this study only and will be destroyed at the end of the study. PLEASE NOTE THAT YOUR CHILD'S PARTICIPATION IN THIS STUDY IS COMPLETELY VOLUNTARY. S/HE WILL NOT BE AFFECTED IN ANY WAY BY PARTICIPATION IN THIS EVALUATION PROJECT. Your child will be told about this study and will be asked to sign an assent form stating whether s/he wants to participate in the study.

Your child's name will not appear in any public document, including articles or reports on the project. All research findings will be completely anonymous. Your child's teacher will be happy to share materials from this program with you at any time.

More information about this project, including details about evaluation, risks, and benefits are outlined on the subsequent pages. If you have any questions about this project, please feel free to contact me or any of the personnel named at the bottom of the consent form.

Sincerely,

Erin L. Dolan, Ph.D.
Principal Investigator
PREP Study
Department of Biochemistry, Fralin Biotechnology Center
(540) 231-2962
edolan@vt.edu

Christine Luketic, Doctoral Candidate
Educational Research and Evaluation
School of Education
Virginia Polytechnic Institute and State University
(540) 231-2642
cluketic@vt.edu

Parental Permission

**VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
PERMISSION FORM FOR PARENT/GUARDIAN OF MINOR PARTICIPANTS**

Title of Project: Partnership for Research & Education in Plants (PREP)
Investigators: Erin Dolan and Compass Consulting Group (Durham, NC)

I. Purpose of this Research/Project

Your child is being invited to participate voluntarily in the above titled research project. The purpose of this project is to examine the impact of PREP on all participants. As part of PREP, an educational evaluator (personnel from Compass Consulting Group), or PREP research staff will determine the impact of different program components using standard educational assessments (pre- and post-tests, interviews, surveys, field observations, instructor notes, and student work). Data acquired from human subjects will be used for programmatic evaluation and may be included in publications about the development and impact of PREP.

The subject pool for PREP includes: high school biology teachers, high school students, and research scientists. In the five years of the project, we will collect data from approximately 100 teachers, 1,000 high school students, and 25 research scientists participating in PREP. Although we will be working with significantly larger numbers of participants, we will confine our data collection to these numbers to ensure reasonable and timely data management and analysis. The only criterion for selection will be that the participant falls into one of the categories of the subject pool (high school biology teacher, high school student, research scientist).

II. Procedures

This evaluation will make use of both quantitative and qualitative methodologies to gather data about the effects of PREP on all participants. Your child may be asked to complete surveys and pre- and post-tests, submit their work, and may be interviewed to examine his/her understanding of genetics, genomics, and scientific inquiry, as well as his/her experiences with PREP. Students work samples and email exchanges with scientists may also be requested. Webchats between scientists and students may also be observed by the evaluator or videotaped and reviewed at a later date. All videotapes will be used for this study only and will be destroyed at the end of the study. No other information will be requested from your child. Data will be shared with project staff to help improve the project. Evaluators will collect data at school with the teacher's and school administrator's permission.

III. Risks

There is no monetary cost to any participants for participation in this project. No participants will encounter any physical, psychological, or sociological risk as a result of their participation in this study. Your child's participation is completely voluntary; if your child does not participate, s/he will not be penalized in any way. Any information s/he provides will be kept confidential and/or anonymous.

IV. Benefits

There are no direct benefits to your child for participating in this study. His/her feedback, however, will be helpful in guiding our future efforts in developing and implementing science activities and curriculum.

V. Extent of Anonymity and Confidentiality

Evaluators will gather data and promise to keep this information confidential. Evaluators will code participants by student id number, which will be used as an identifier on any written material. Names of participants are not required for completion of the research and thus will not be recorded. Evaluators will ensure that participants remain confidential to the rest of the project staff. Findings from this research will be made available to project staff and possibly to leaders who have participated in the project. At no time will the researchers release the results of the study to anyone other than individuals working on the project without your written consent. Data will be retained for a minimum of five years past the termination date of the grant (September 30, 2008).

VI. Compensation

Your child will not be compensated in any way for his/her participation in the study.

VII. Freedom to Withdraw

Your child is free to withdraw from this study at any time without penalty. S/he is free not to answer any questions or respond to experimental situations that s/he chooses without penalty.

VIII. Approval of Research

This research project has been approved, as required, by the Institutional review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University.

IRB Approval Date

Approval Expiration Date

IX. Subject’s Permission

I have read and understand the Parent/Guardian Permission and conditions of this project. I have had all of my questions answered. I hereby acknowledge the above and give my voluntary permission for my child’s participation in this study:

Parent/Guardian signature

Date: _____

Should I have any pertinent questions about this research or its conduct, and research subjects’ rights, and whom to contact in the even of a research-related injury to the subject, I may contact:

Investigators: Erin Dolan, Ph.D. (540) 231-2692 edolan@vt.edu
Christine Luketic (540) 231-2642 cluketic@vt.edu

Amy Germuth, Ph.D. (877) 652-0189
agermuth@mindspring.com
Compass Consulting Group, Durham, NC

Department Head: Peter Kennelly, Ph.D. (540) 231-4317 pjkennel@vt.edu
David M. Moore (540) 231-4991 moored@vt.edu
Chair, IRB
Office of Research Compliance
Research and Graduate Studies

This Informed Consent is valid for one year from the date of signing.

Student Assent
MINOR SUBJECT'S ASSENT FORM
Partnership for Research & Education in Plants (PREP) Study

Dear Student,

Your teacher is participating in a program called PREP, to help you learn about and participate in science research. We are examining what effect this program has on your teacher, you, and the scientist you are collaborating with. In order to do this, we will be examining what you learn during your biology class. We will ask you about what you learn about scientific research, biotechnology, genetics, and genomics.

If you give permission, you may be interviewed. A visiting project evaluator may ask you questions about the activities you are doing and about your biology class in general. Work samples you produce and email exchanges between you and the scientist involved may also be requested. You may also be asked to complete a survey related to your attitudes towards science. Webchats between you and the scientist may also be observed by the evaluator or videotaped and reviewed at a later date. All videotapes will be used for this study only and will be destroyed at the end of the study. **YOUR DECISION ABOUT WHETHER OR NOT TO PARTICIPATE IN THIS RESEARCH PROJECT WILL NOT AFFECT YOU IN ANY WAY**, and your responses will be kept anonymous. Your guardian has signed a form giving consent for you to participate in this project. Do you agree to participate in this project?

Subject's signature: _____

Subject's name: _____

Date: _____

This Assent Form is valid for one year from the date of signing.

Appendix D
Introductory Letters

Dear [teacher name]-

We're glad to have you and your students participating in PREP! David may have mentioned that we do a fair bit of research and evaluation on PREP to inform further development of the program and learn about its impact.

To that end, would you be willing to ask your students to complete a 30 minute survey? More details are included below. Please feel free to contact Christine Luketic or myself if you have any questions or concerns, or if you need any additional information.

Thanks for considering this-
we look forward to hearing from you!

Best wishes,

Erin Dolan (principal investigator) and Christine Luketic (doctoral student)

As you may know, the Partnership for Research and Education in Plants (PREP) is intended to be both an educational and research effort – the research includes your students' scientific work and our understanding of how an experience like PREP impacts all of its participants, students, teachers, and scientists.

Over the past several years, we have collected data on PREP's impact through surveys, focus groups, interviews, and students' work. Recently, we have become interested in whether and how PREP participation relates to student attitudes toward science and academic achievement. For example, is there any relationship between students' attitudes toward their science lab work and their participation in PREP? Is there any relationship between students' responses on PREP surveys and their achievement? etc.

Because PREP is a research collaboration, we anticipate that students might think differently and/or more critically about science as a result of their participation. PREP may also impact their overall attitude about science labs. In addition, we think students' attitudes toward science may be influenced differently by PREP in a way that correlates with their grades. For example, students who have higher grades in science may already have positive attitudes about it, while students who have lower grades may be less positive, but may become more positive as a result of participating in PREP.

To answer these questions, we would like to invite students who are participating in PREP to complete the Science Laboratory Environment Inventory (SLEI), a survey first developed by

Barry Fraser in the 1990s. Each question is an opinion statement related to the student's perception of and preferences about their science classroom environment. It assesses five dimensions of the actual and preferred environment of science laboratory classes: student cohesiveness, open-endedness, integration (fit into flow of class activities), classroom norms (safety, behavior expectations, etc.), and material environment (supplies, equipment, etc.).

The survey would take approximately 30 minutes to complete. We would collect student IDs to uniquely identify their responses, while maintaining their confidentiality at all times. Any findings will be reported in aggregate so that no single student, or group of students working with a single teacher, could be identified. Students' responses will help validate the instrument, which could serve as a tool for examining students' learning through attitudes and behaviors rather than standardized testing.

Please let me know if you think your students would be able to participate in this survey. Of course, whether or not you are willing to ask your students to participate will not influence your or their participation in PREP in any way. If you are interested, we will forward the official letter of invitation and consent and assent forms. Also, please feel free to contact us with any questions or concerns or if you would like additional information.

Erin L. Dolan, Ph.D.
Assistant Professor, Biochemistry
Outreach Director, Fralin Biotechnology Center
Virginia Tech
West Campus Drive MC 0346
Blacksburg, VA 24061

(540) 231-2692 phone
(540) 231-7126 fax
edolan@vt.edu

Introductory Email-Biotech-in-a-Box

Dear [teacher name],

Hope your new year is starting well!

I have a favor to ask. We are trying to conduct some research and evaluation of the Biotech-in-a-Box program to inform further development and learn about the impact of the program. Would you be willing to ask your students to complete a 30 minute survey? The research is being conducted by one of Erin Dolan's doctoral students, Christine Luketic. If you are interested, please contact her at (540) 231-2642 or cluketic@vt.edu. She will likely follow up this email by directly contacting you.

More details of the survey are included below. If you have any questions or concerns, or if you need any additional information before you make a decision, you may contact Chris (Or you can call or email me, of course, but this will be Chris's research, so she'll know the most about it.)

Needless to say, whether you chose to participate in this research will have absolutely no impact on your participation in the Biotech-in-a-Box program.

Thanks for considering this - we look forward to hearing from you!

Best wishes,
Kristi

Details:

Over the past several years, we have collected data on the Biotech-in-a-Box program through brief questionnaires. Recently, we have become interested in whether and how participation in this program relates to students' academic achievement as well as their attitudes toward science. For example, is there any relationship between students' attitudes toward their science lab work and their experience with Biotech-in-a-Box? Is there any relationship between students' attitudes toward lab experiences and their achievement? etc.

We anticipate that students may think differently and/or more critically about science as a result of their work with Biotech-in-a-Box. Their experience may also impact their overall attitude about science labs. In addition, we think students' attitudes toward science may be influenced differently in a way that correlates with their grades. For example, students who have higher grades in science may already have positive attitudes about it, while students who have lower grades may be less positive, but may become more positive as a result of participation.

To answer these questions, we would like to invite students who are using the Biotech-in-a-Box kits to complete the Science Laboratory Environment Inventory (SLEI), a survey first developed

by Barry Fraser in the 1990s. Each question is an opinion statement related to the student's perception of and preferences about their science classroom environment. It assesses five dimensions of the actual and preferred environment of science laboratory classes: student cohesiveness, open-endedness, integration (fit into flow of class activities), classroom norms (safety, behavior expectations, etc.), and material environment (supplies, equipment, etc.).

The survey would take approximately 30 minutes to complete. We would collect student IDs to uniquely identify their responses, while maintaining their confidentiality at all times. Any findings will be reported in aggregate so that no single student, or group of students working with a single teacher, could be identified. Students' responses will help validate the instrument, which could serve as a tool for examining students' learning through attitudes and behaviors rather than standardized testing.

Please let me know if you think your students would be able to participate in this survey. Of course, whether or not you are willing to ask your students to participate will not influence your or their participation with Biotech-in-a-Box in any way. If you are interested, we will forward the official letter of invitation, parent consent forms, and student assent forms. Also, please feel free to contact us with any questions or concerns or if you would like additional information.

Thank you for considering this invitation.

Best wishes,

Christine Luketic
Doctoral Student
(540) 231-2642
cluketic@vt.edu

Erin L. Dolan, Ph.D.
Assistant Professor, Biochemistry
(540) 231-2692
edolan@vt.edu

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Kristi R. DeCourcy, Ph.D.
Laboratory Manager
Fralin Biotechnology Center
Virginia Tech
West Campus Drive
Blacksburg, VA 24061
Phone: (540) 231-7959 Fax: (540) 231-7126
<http://www.biotech.vt.edu>

Memo to Participating Teachers

[Date, 2007]

Hi [Teacher Name]

Thank you for agreeing to help us out with the student survey. Enclosed are the materials for the survey.

There are three sets of documents:

1. The first set of documents is the letter to the parents describing the survey research and asking for permission. Attached to these letters are two permission forms on pink paper. This is so that they can sign and return one form and then have a copy to keep for their own records.
2. The second set of forms is the student assent form for the survey. This is on green paper. Both the consent forms and the assent forms should be signed before the students complete the survey.
3. The third set of forms is the directions and the survey. This is on yellow paper. The survey should take about 30 minutes to complete.

I have completed a return Fedex form so that you may send back the surveys, the assent forms and the consent forms when they are completed.

If you have any questions, please feel free to contact me.

Thanks

Chris Luketic
Cluketic1@mac.com
Doctoral Candidate
Educational Research and Evaluation
School of Education
Virginia Tech

540-951-1751

Appendix E

Permission to use the SLEI from instrument author

From: B.Fraser@curtin.edu.au
Subject: RE: Science Laboratory Environment Inventory
Date: November 10, 2006 8:08:06 PM EST
To: cluketic1@mac.com

Christine

You have my permission to use the SLEI.

Good luck with your research.

Barry Fraser

From: Christine Luketic [mailto:cluketic1@mac.com]
Sent: Sat 11/11/2006 12:05 AM
To: Barry Fraser
Subject: Science Laboratory Environment Inventory

Dr.Fraser,

I am a doctoral candidate at Virginia Tech in Blacksburg, Virginia, USA. I am interested in using the SLEI to collect data for my dissertation from high school students. What steps do I need to complete to obtain your permission for use of the instrument? I appreciate your help with this.

Thank you for your time

Christine Luketic