Summary of the Development and Use of the *Inventory for Teaching and Learning* (ITAL) in the External Evaluation of the Georgia Partnership for Reform in Science and Mathematics (PRISM)

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Introduction

This document provides a brief description of the *Inventory of Teaching and Learning* (ITAL) developed and currently being implemented as one component of an external evaluation of the Georgia Partnership for Reform in Science and Mathematics (PRISM). The Georgia PRISM program is a cooperative partnership between four regional higher education institutions and their surrounding school districts. The PRISM external evaluation is a longitudinal (2003-2008), mixed methods (qualitative and quantitative) effort to document change processes and outcomes in K-16 science and mathematics. The change model includes emersion of K-12 teachers and higher education faculty in professional development and in-service education programs, learning communities, and faculty institutes.

The ITAL is a *web-based survey* of teaching and learning practices designed to reflect reformed (inquiry-based and standards-based) teaching and learning environments/practices and more traditional learning environments/practices. Included in this document are: (a) a brief description of the historical development of the ITAL; (b) a summary of the current (third) form of the ITAL items and their empirical classifications on three measurement dimensions; and (c) some suggested uses of the ITAL. More detailed descriptions of the methodology used to develop the ITAL can be found in Ellett, Monsaas, Payne, & Pevey (2005; 2006) and Ellett & Monsaas (2007).

Development of the ITAL

The initial development of the ITAL began in 2003-2004. Our focus was the extent to which K-16 faculty reported the emphasis that was placed on a list of teaching and learning practices in their classroom(s). A scale ranging from 1=No Emphasis to 6=Very Strong Emphasis was developed for rating each ITAL item. The initial pool of items was developed to reflect core observation and assessment concepts reflected in the Reformed Teaching Observation Protocol (RTOP) (Sawada, Pibum, Turley, Falconer, Benford, & Judson). The RTOP was developed through the Arizona Collaborative for Excellence in the Preparation of Teachers (ACEPT) at Arizona State University. The RTOP is designed to measure 25 core elements of reformed (standards-based and inquiry-based) teaching. The initial pool of ITAL items included 39 reformed teaching and learning activities and 6 traditional teaching practices. The ITAL was administered to 3,094 K-16 faculty in PRISM universities and schools in the spring of 2004. Extensive statistical analyses of these data identified five measurement dimensions that retained 31 of the 45 original items.

Because of the small number of ITAL items defining the identified measurement dimensions and the need to better measure elements of a standards-based and inquiry-based teaching and learning environment, an additional set of 21 ITAL items was developed for a second web-based administration in the spring of 2005. A key source used for inquiry-based items was the *Enabling Thinking Domain* of the Professional Assessment and Comprehensive Evaluation System (PACES) (Ellett, 2002), a complex classroom observation measure of teaching and learning. This second version of the ITAL (52 items) received responses from 4,364 K-12 faculty members in the spring of 2005. Extensive statistical analyses of these data

identified three core measurement dimensions: (a) *Inquiry-Based* teaching and learning; (b) *Standards-Based* teaching and learning; and (c) *Traditional* teaching and learning. These analyses retained 48 of 52 items distributed across the three measurement dimensions.

A third administration of the ITAL was completed in the spring of 2006. Because of the need to better measure traditional teaching and learning practices, eight additional ITAL items were written to reflect these practices. A total of 56 ITAL items was administered via the web to 5,796 K-12 teachers. Extensive statistical analyses of these data *very strongly replicated* the spring 2005 results and provided additional verification of the three ITAL measurement dimensions (inquiry-based, standards-based, and traditional teaching and learning environments/practices). Only 4 of 56 ITAL items were deleted from the 2006 revision of the ITAL that will be administered in the spring of 2007.

Considered collectively, the continued development and results of three large sample studies of the ITAL in Georgia provide strong empirical support for what the ITAL measures, its statistical reliability (2005 coefficients for the three measurement dimensions ranged from .91 to .83), and its utility in monitoring what PRISM science and mathematics teachers report about the emphasis they place on various teaching and learning practices. The results of recent analyses of the 2006 ITAL continued to document rather high internal consistency (Cronbach Alpha) reliability coefficients for the ITAL measurement dimensions (Inquiry-Based, Alpha = .97; Standards-Based, Alpha = .88; and Traditional, Alpha = .83).

Additional validity characteristics of the ITAL will be studied during the spring of 2007. The PRISM external evaluation team will examine linkages between the ITAL, the RTOP (actual observations and assessments of everyday practices and attempts at implementing inquiry-based lessons), rates of student engagement in learning, and variation in the degree to which teachers are or have been involved in PRISM professional development/in-service programs and PRISM learning communities.

What Do the ITAL Measurement Dimensions Measure?

A series of Principal Components Analyses of the 2005 and 2006 ITAL data bases identified and clearly replicated three core measurement dimensions (scales or factors): (1) *Inquiry-Based Teaching and Learning*; (2) *Standards-Based Teaching and Learning*; and (3) *Traditional Teaching and Learning*. Each of these measurement dimensions is briefly defined in the sections that follow.

<u>*Inquiry-Based Teaching and Learning*</u>

This ITAL dimension reflects a teaching and learning environment that is student-centered rather than teacher-centered. The primary responsibility for developing knowledge resides with students rather than with the teacher. In this kind of environment, students are encouraged to develop their own personal understandings by filtering through and integrating new knowledge with their personal, real world (life) experiences, other disciplines, and knowledge shared among students and the teacher as a community of learners. The teacher's

primary role is to facilitate, guide, and encourage students to develop and understand key concepts, to puzzle through problems, to see multiple ways of answering questions, to make conjectures and find solutions, to collect and weigh evidence, and to develop, articulate, and test ideas. The construction of knowledge by students is valued. Multiple forms of assessment are used to make inferences about student learning.

Standards-Based Teaching and Learning

This ITAL dimension reflects a teaching and learning environment in which specific curriculum objectives and teaching and learning activities are derived from state, national and/or professional standards. Performance outcomes and high performance expectations are made explicit to students. The levels of knowledge acquisition and understanding needed to accomplish learning objectives and to achieve standards are made explicit and communicated by the teacher. A clearly defined sequence of teaching and learning activities is planned and implemented. State, national, and/or professional standards are used to develop standardized assessments of student learning and achievement, and mastery learning is valued.

Traditional Teaching and Learning

This ITAL dimension reflects a teacher-controlled rather than student-centered teaching and learning environment. The teacher's primary roles are to dispense knowledge, provide examples, articulate ideas, and identify and solve problems while students remain active listeners. Direct instruction is valued. Performance expectations and learning outcomes are, with few exceptions, the same for all students. The content to be covered, the nature of subject matter, the sequence of learning, the time allocated for learning activities, and the methods used are typically the same for all students, and are controlled by the teacher. The same set of procedures is used to assess the learning and performance of all students.

In the 2006 Principal Components Analyses, four ITAL items were clearly loaded on two measurement dimensions and these items were not retained in the current 52-item ITAL (as shown in **APPENDIX A**). These four items and their item/dimension loadings (correlations) were as follows:

#23 Communicating the value of every student's ideas and opinions. (.49, Inquiry-Based; .44, Standards-Based)

#25 Requiring students to actively participate and to make contributions to knowledge development and learning. (.46, Inquiry-Based; .45, Standards-Based)

#46 Encouraging students to work collaboratively. (.49, Inquiry-Based; .41, Standards-Based)

#47 Providing equal opportunities for students to participate in teaching and learning activities. (.45, Inquiry-Based; .45, Standards-Based)

The loadings of these four items on both the Inquiry-Based and Standards-Based Teaching and Learning Components make intuitive sense.

It should be recognized here that the three measurement dimensions of the ITAL *do not* reflect discrete categories or pure typologies of teaching and learning environments. In most classrooms, and particularly over many lessons, teaching and learning include a variety of activities that reflect multiple elements of each of the three ITAL domains. *Reformed teaching and learning*, however, will move away from traditional classroom environments and practices toward standards-based and inquiry-based classroom environments and practices.

The 2007 ITAL

The third revision of the ITAL will be administered to Georgia PRISM K-16 faculty in the spring of 2007. **APPENDIX A** includes the ITAL item rating scale (Degree of Emphasis) and the current set of 52 ITAL item statements, followed by a summary classification of each item as a measure of *Inquiry-Based* (n=30 items), *Standards-Based* (n=10 items), or *Traditional* (n=12 items) teaching and learning environments/practices. The classification of items is derived from the results of the statistical analyses of data from the spring 2006 administration of the ITAL in Georgia. The identification of each item with measurement dimension follows each item in parenthesis (I = Inquiry-Based; S = Standards-Based; T = Traditional). A second parenthesis following each item statement is the statistical loading (correlation) the item with the measurement dimension resulting from the Principal Components Analyses of the 2006 ITAL database.

Table 1 includes ITAL item means and standard deviations for the entire sample (n=5796) of science and mathematics teachers, *for all 56 ITAL items*. In this analysis, sample sizes vary somewhat from one item to the next because of missing data. Table 2 shows descriptive statistics (grand means, standard deviations, and grand means expressed as percentages of the maximum possible ITAL dimension score for elementary, middle, and high school science teacher groups. Table 3 includes the results of the same analyses for mathematics teacher groups.

The ITAL has also been used with college faculty members in science and mathematics. Only one item is changed in the higher education form of the ITAL to be consistent with higher education terminology. Item 1 has been changed to read as follows: *Teaching to a set of clearly stated learning outcomes.*

Possible Uses of the ITAL

Beyond the PRISM external evaluation effort in Georgia, the ITAL may have a variety of additional uses in the improvement of teaching and learning in science and mathematics (and perhaps other disciplines as well). Assessment results aggregated by one or more of the ITAL empirical dimensions, or summarized at the individual item level, have many implications for teacher development, developing program evaluation and education change models, or

improving teaching and learning environments. *Some* of these are included in the bullets that follow. The ITAL assessment dimensions and accompanying items might be used:

- as outcome measures in studies of change to move toward more reformed teaching and learning environments over time

- to develop a web-based system for teachers to complete a self assessment with the ITAL and then compare self-assessment results to normative scores for similar groups of teachers (e.g., by subject matter, grade level, geographical regions)

- as a means of self-assessment results to identify strengths and weaknesses in teaching and learning practices and to define professional development needs

- as a basis for learning community conversations and sharing among teachers and/or teachers and students

- as a means of training school administrators, lead teachers, curriculum specialists and others to observe and make formative assessments of reformed (inquiry-based, standards-based) versus more traditional teaching and learning environments and practices

- with teachers to develop an extended, annotated document (Interpretive Guide) that provides rich examples of different teaching and learning practices that occur in reformed education environments

- to stimulate discussions about reformed teaching and learning among faculty and students in teacher preparation programs

- to enhance discussions between students and teachers about the different roles they have in reformed (inquiry-based and standards-based) versus more traditional teaching and learning environments/practices

- to develop a parallel form of the ITAL to measure student perceptions of the teaching and learning environment

- as a framework for developing pre-service teacher education curricula for science and mathematics teachers (and perhaps for other teachers as well)

References

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Sawada, D., Pibum, M., Turley, J., Falconer, K., Benford, R., & Judson, E. *Reformed Teaching Observation Protocol (RTOP) Training Guide*. Arizona State University, Arizona Collaborative for Excellence in the Preparation of Teachers. ACEPT Technical Report No. IN00-2.

Table 1

Summary of Descriptive Statistics for PRISM K-12 Math and Science Teachers for the
Inventory of Teaching and Learning (*ITAL*) Administered in Spring 2006 (n=5,796)

	N	Mean	S.D.
ITAL Item #			
1.	5716	5.53	.80
2.	5767	4.97	1.03
3.	5756	5.09	1.04
4.	5731	4.77	1.07
5.	5767	4.84	1.11
6.	5742	4.11	1.25
7.	5791	4.65	1.12
8.	5740	4.77	1.10
9.	5799	4.83	1.11
10.	5760	4.94	1.04
11.	5781	4.50	1.19
12.	5756	4.68	1.12
13.	5784	4.60	1.21
14.	5790	3.74	1.36
15.	5708	3.01	1.35
16.	5594	4.78	1.08
17.	5768	4.64	1.24
18.	5767	4.82	1.09
19.	5769	4.53	1.17
20.	5784	4.64	1.14
21.	5787	4.05	1.24
22.	5750	5.16	.93
23.	5751	4.25	1.24
24.	5755	5.16	1.03
25.	5780	4.75	1.07
26.	5786	3.62	1.39
27.	5749	4.85	1.01
28.	5722	3.62	1.34
29.	5699	4.07	1.26
30.	5636	4.46	1.09
31.	5721	4.38	1.20
32.	5686	3.94	1.34
33.	5762	4.77	1.17
34.	5714	4.33	1.28
35.	5740	4.90	1.10
36.	5743	4.97	1.01
37.	5750	4.74	1.15
38.	5699	4.56	1.10

39.	5742	3.35	1.46
40.	5728	3.57	1.40
41.	5713	3.02	1.36
42.	5678	3.05	1.50
43.	5695	5.67	.70
44.	5719	5.40	.81
45.	5724	5.30	.97
46.	5681	5.16	1.05
47.	5712	4.43	1.43
48.	5645	5.12	.97
49.	5715	5.29	.89
50.	5690	5.22	.89
51.	5713	5.26	.87
52.	5688	5.23	.91

Table 2

Descriptive Statistics for Each ITAL Measurement Dimension for all Elementary (n=2187), Middle (n=248), and High School (n=246) *Science Teachers*

Inquiry-Based	<u>Mean</u>	<u>S.D</u>
Elementary	4.70	0.80
Middle	4.64	0.80
High School	4.52	0.82
Standards-Based		
Elementary	5.33	0.62
Middle	5.19	0.72
High School	5.13	0.71
Traditional		
Elementary	3.83	0.79
Middle	3.73	0.75
High School	3.84	0.79

Table 3

Descriptive Statistics for Each ITAL Measurement Dimension for all Elementary (n=2444), Middle (n=397), and High School (n=274) *Mathematics Teachers*

Inquiry-Based	Mean	S.D.
Elementary	4.74	0.76
Middle	4.50	0.79
High School	4.33	0.82
Standards-Based		
Elementary	5.39	0.57
Middle	5.18	0.70
High School	5.03	0.70
Traditional		
Elementary	3.83	0.80
Middle	3.71	0.71
High School	3.95	0.74

APPENDIX A

PRISM *Inventory of Teaching and Learning* (ITAL) (K-12 Version)

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*Note: Following are some demographic data that are routinely gathered from test takers. ITAL is administered on line so that respondents will go directly to the appropriate questions. The Inventory is administrated twice to teachers who teach both mathematics and science. **Other demographic information of interest can be collected by those using the ITAL.**.*

Select which best describes the area in which you teach:
1. Mathematics - I currently teach mathematics
2. Science - I currently teach science
3. Both Mathematics and Science - I currently teach both mathematics and science
4. I currently do not teach mathematics or science (Do not complete the survey)

MATHEMATICS TEACHERS

Select which best describes the area **(mathematics)** in which you teach:
1. Elementary school (grades K-5)
2. Middle school (grades 6-8)
3. High school (grades 9-12)

Please identify the class / course **(elementary)** you most frequently teach:
1. Mathematics - Grade K
2. Mathematics - Grade 1
3. Mathematics - Grade 2
4. Mathematics - Grade 3
5. Mathematics - Grade 4
6. Mathematics - Grade 5

Please identify the class / course **(middle school)** you most frequently teach:
1. Mathematics - Grade 6
2. Mathematics - Grade 7
3. Mathematics - Grade 8
4. Pre-Algebra and/or Algebra
5. Geometry

Please identify the class / course **(high school)** you most frequently teach:
1. Basic / Concepts / Applied Mathematics
2. Algebra I
3. Algebra II
4. Geometry
5. Advanced Mathematics

SCIENCE TEACHERS

Please identify the class / course **(science)** you most frequently teach:
1. Elementary school (grades K-5)
2. Middle school (grades 6-8)
3. High school (grades 9-12)

My current science teaching assignments **(elementary)** are predominantly in:
1. Science - Grade K
2. Science - Grade 1
3. Science - Grade 2
4. Science - Grade 3
5. Science - Grade 4
6. Science - Grade 5

Please identify the class / course **(middle school)** you most frequently teach:
1. Physical Science or Integrated Science
2. Life Sciences or Integrated Science
3. Earth Science or Integrated Science

Please identify the class / course **(high school)** you most frequently teach:
1. Biology
2. Physical Science
3. Chemistry
4. Physics
5. Earth or Environmental Science
6. Other Science Courses - General
7. Other Science Courses – Advanced

PRISM *Inventory of Teaching and Learning* (ITAL) (K-12 Version)

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<u>Directions</u>

If you teach both math and science, you will complete the survey separately for each subject. When completing the survey have the course that you most typically teach in mind. Make a judgment relative to the emphasis you place on each of the following practices. Make your estimate for each practice separately from the others. Using the six-point scale provided below, choose one number that best reflects the degree of emphasis you *typically give* to that practice. Remember that it is not expected or desirable that you would emphasize all these practices in one course. You will have the opportunity at the end of the survey to provide additional comments on specific items.

Scale:

> **1 = No Emphasis**
> **2 = Limited Emphasis**
> **3 = Some Emphasis**
> **4 = Moderate Emphasis**
> **5 = Strong Emphasis**
> **6 = Very Strong Emphasis**

1. Teaching to a set of state (e.g., Georgia QCC/GPS) or national standards. (S) (.37)

2. Reviewing and processing students' prior knowledge, ideas, and preconceptions before implementing new lessons. (I) (.48)

3. Engaging students as members of a learning community. (I) (.52)

4. Providing opportunities for students to seek alternative modes of investigation and problem solving. (I) (.71)

5. Asking students to demonstrate more than one way to solve a problem. (I) (.66)

6. Allowing students' ideas to determine the focus and direction of the lesson. (I) (.68)

7. Encouraging students to generate alternative solution strategies and/or different ways of interpreting evidence. (I) (.75)

8. Asking student for examples and non-examples of concepts. (I) (.61)

9. Teaching students how to collect, organize, analyze, present, and evaluate data/information. (I) (.67)

10. Providing opportunities for students to make predictions, estimations, and/or hypotheses. (I) (.68)

11. Providing opportunities for students to devise means for testing their predictions, estimations, and/or hypotheses. (I) (.73)

12. Providing opportunities for students to evaluate their own thinking throughout the lesson. (I) (.75)

13. Engaging students to discuss and debate their ideas. (I) (.73)

14. Planning the same lessons for all students. (T) (.65)

15. Using fill-in-the blank worksheets. (T) (.39)

16. Challenging students to justify their answers and conclusions. (I) (.63)

17. Using a variety of means and methods to involve students in the communication of ideas (e.g., making presentations, brainstorming, critiquing, listening, making videos, group work). (I) (.68)

18. Asking open-ended questions that foster divergent modes of thinking. (I) (.72)

19. Asking questions that frame problems with more than one interpretation and/or solution. (I) (.78)

20. Implementing learning activities that require students to engage in discussions among themselves. (I) (.74)

21. Providing opportunities for students to influence the direction of the lesson. (I) (.74)

22. Recognizing students' opinions, ideas, and/or contributions. (I) (.57)

23. Evaluating student learning and/or performance on the basis of right and wrong answers. (T) (.46)

24. Using a variety of hands-on activities. (I) (.49)

25. Shifting the primary responsibility for thinking and learning from the teacher to the students. (I) (.65)

26. Using the same aids and materials with all students. (T) (.72)

27. Allowing sufficient time for students to make contributions and to develop their ideas.(I) (.58)

28. Using the same methods with all students to explain important parts of the lesson. (T) (.71)

29. Allowing students to lead class discussions. (I) (.66)

30. Using direct instruction to teach knowledge and skills. (T) (.46)

31. Encouraging students to question and critique knowledge claims made by other students. (I) (.70)

32. Cautioning students about the tentative nature of knowledge as they observe, experiment, and solve problems. (I) (.70)

33. Encouraging students to work together to resolve differences in their views of the best way to answer questions or to solve problems. (I) (.61)

34. Allowing students to negotiate learning outcomes as they attempt to solve problems. (I) (.67)

35. Showing students how to break complex problems into smaller problems. (I) (.52)

36. Encouraging students to think through different ways to solve problems and to predict outcomes. (I) (,65)

37. Encouraging students to examine their personal thinking processes. (I) (.67)

38. Controlling the sequence and content of learning. (T) (.44)

39. Using one standard procedure to assess learning for all students. (T) (.75)

40. Asking all students the same general and/or specific questions. (T) (.77)

41. Using the same teaching methods for all students. (T) (.79)

42. Allocating the same amount of time for learning for all students. (T) (.64)

43. Communicating that all students can learn. (S) (.57)
44. Demonstrating patience and understanding when students have difficulties or search for solutions to problems. (S) (.57)

45. Using state, national and/or professional organization standards to develop teaching and learning activities. (S) (.68)

46. Using state, national and/or professional organization standards to develop assessments of student learning and achievement. (S) (.56)

47. Maintaining the same performance expectations for all students. (T (.41)

48. Making performance outcomes explicit to students. (S) (.59)

49. Encouraging students to make connections between the curriculum, teaching and learning activities, their interests and life experiences. (S) (.60)

50. Planning learning experiences for students around clearly defined learning outcomes. (S) (.73)

51. Determining a sequence of learning experiences with the end clearly in mind. (S) (.72)

52. Clearly articulating the understandings needed by students to meet performance standards. (S) (.70)

Comments

We have included this section in the administration of the ITAL to collect any comments teachers might want to make about this new measure.