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Students' Perceptions of Science Classes in the Philippines

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This study used a modified version of the Perception of Science Classes Survey (Kardash & Wallace, 2001) to survey 7,885 grade school and high school students in different provinces in the Philippines regarding their perceptions of their science classes. Factor analysis revealed five dimensions of the students' perceptions that relate to different aspects of the teacher's pedagogy and the learning environment created by the teachers: (a) Learner-Centered Pedagogy, (b) Science Inquiry Activities, (c) Positive Affect and Attitudes, (d) Grades as Feedback, and (e) Support for Self-Learning and Effort. Factor scores were compared across grade levels and genders. The results indicate a decrease in science inquiry activities and the use of grades as feedback in the higher grades, but an increase in support for self-learning and effort, and also positive affects and attitudes. These trends were discussed in relation to possible problems related to teacher practices that may contribute to low student achievement levels in science.

Key words: student perceptions, science education, Philippines

Filipino students' poor achievement levels in science have been documented for several years now. In 1996, the national mean score in the science test of the National Elementary Achievement Test was 41.5%. A recent National Achievement Test showed that in 2005, the mean score in the science test was 54.1% for grade 6 students, and only 14.8% of grade 6 science students attained mastery levels of the science curriculum goals. For the 4^{th} year high school students, the National Achievement Test in science showed a mean score of 39.5%; only 1.8% of the students attained mastery levels of science curriculum goals. These low achievement levels are also documented in international assessments of science education. In the Trends in International Math and Science Study (Martin, Mullis, Gonzalez, & Chrostowki, 2004), Filipino grade 4 students ranked third from last out of 25 countries in science, with an average rating of 332. The average international rating was 489, and the highest rating by any country was 565. The grade 8 students ranked fourth from last out of 46 countries with an average rating of 377 in science. The average international rating was 474, and the highest rating by any country was 578. The TIMSS also showed that among grade 4 students, girls performed better than boys, but that this advantage of girls was no longer found in grade 8.

Many different studies have analyzed the sources of the problem and these analyses have pointed to a range of interrelated factors such as an inadequate science curriculum

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(Bernardo, 1998, 2004), poor preparation of teachers in terms of science content and pedagogy (Bernardo, 2002; 2004; Golla & De Guzman, 1998), the inefficient administration for the delivery of science education (Nebres & Vistro-Yu, 1998), and even the lack of a science culture in the country (Nebres & Intal, 1998). However, some educational scholars have noted that there does not seem to be a coherent framework for science education reform (Bernardo, 1998, 1999). In this study, we draw from the methods of educational psychology to gain insight into the problems of poor achievement in science education by exploring students' perceptions of their science classes, using a paper-and-pencil test developed by educational psychologists in the United States for the same purpose.

Student Perceptions and Science Learning

Researchers in developed countries like the United States have focused on students' perceptions of science classes to try to understand some of the problems in the science education system in their countries. Such studies have revealed insights into some of the causes of specific problems in science education. For example, Tobias (1990) interviewed undergraduate students who switched from a science (or mathematics) major to a non-science major and found that these students pointed to aspects of the teaching approaches of science teachers that contributed to their "dissipating interest" in science. Similar perceptions were reported by Seymour (1992, 1995; Seymour & Hewitt, 1997) in separate studies on science and math majors. Seymour and Hewitt's (1997) study revealed many informative perceptions of students, such as the perception that science teachers dislike their students and do not have the motivation to teach effectively. The students interviewed also perceived many features of ineffective teaching in science such as the lack of fit between the materials used in class and the tests and assignments, the use of grading practices that do not reflect actual student learning, an overemphasis on memorization instead of conceptual understanding and establishing conceptual connections, among many others. Their study of students' perception revealed notions of good teaching in science classes, such as encouraging discussion, and valuing the sense of discovering things together, and respecting students, among others (see also Strenta, Elliot, Adair, Matier, & Scott, 1994).

These studies on students' perceptions have utilized qualitative research methodologies, mainly involving interviews of students. Fairly recently, Kardash and Wallace (2001) developed a paper-and-pencil test that would allow for a more efficient and precise approach to studying student perceptions of their science classes. The Perceptions of Science Classes Survey (PSCS) was developed using the conventional approaches in the construction of psychological survey instruments, and was validated for use among American students. Their analysis of PSCS revealed six factors representing different dimensions of the students' perceptions: (a) Factor 1: Pedagogical Strategies, (b) Factor 2: Faculty Interest in Teaching, (c) Factor 3: Student Interest and Perceived Competence in Science, (d) Factor 4: Passive Learning, (e) Factor 5: Grades as Feedback, and (f) Factor 6: Laboratory Experiences.

Using their validated survey instrument, Kardash and Wallace were able to obtain quantitative data on student perceptions that further support the findings of previous studies that reveal perceptions related to the problems of teaching in science classes. The advantage of using the PSCS is that it can be administered relatively easily to large numbers of students, and can thus be used to study perceptions of students for various types of research problems in a more efficient way.

The Present Study

For the purposes of this study, we developed a survey questionnaire based on the PSCS to study perceptions of Filipino students regarding their science classes. Even without going into detail, there are obvious differences in the science education systems of the Philippines and the United States related to the level and types of resources used in science teaching, the goals, nature, and focus of the science curriculum, among others. Thus, there was a need to adapt and to revise the PSCS for use among Filipino students. The details about how the PSCS was adapted are revised are described in the method sections.

Using the survey instrument developed, the dimensions of the perceptions of the Filipino science students were determined using factor analysis. We did not assume that the factors found in the Kardash and Wallace (2001) study would also apply to the Filipino students' perceptions. After determining the factors or dimensions of Filipino science students' perceptions of their science classes, we wanted to track changes in the perceptions from a cross-sectional approach by comparing the perceptions of students from grades 5–10. The data shown earlier indicate that the Filipino students' achievement levels in science decline from grade school to high school. This study will also compare perceptions of female and male students, and track the differences if any across grade levels. The TIMSS science achievement data suggested that there is a gender difference, where females tend to attain higher levels of achievement compared to their male counterparts in grade school, but not in high school. The study sought to determine whether changes in the perceptions of the students reflect trends in the achievement levels of the Filipino students.

Method

Participants

The participants in the study were 7,914 students in 30 grade schools and 30 high schools in three different regions of the country. The basic education system in the Philippines involves six years of elementary and four years of high school. The participants in the study involved those in the last two years of elementary (grades 5 & 6), and the first to fourth years of high school (referred to in this paper as grades 7-10), all of whom are taking the mandatory science subject in the basic education curriculum. Of the total, two students failed to indicate their grade level on the questionnaire, and another 27 did not indicate their gender. The data from these 29 students were excluded from the analysis, leaving a total of 7,885 participants. The distribution of student participants for each level and gender is shown in Table 1.

Table 1
Distribution of Participants by Level and Gender

Level	Male	Female	Total
Grade 5	588	669	1257
Grade 6	557	710	1267
Grade 7	590	767	1357
Grade 8	533	832	1365
Grade 9	562	802	1364
Grade 10	479	796	1275
Total	3309	4576	7885

Instrument

The PSCS was adapted for use in the study, with permission from the original authors. The first consideration was the age difference among the students in the original study that validated the PSCS and those in the current study. The PSCS was first studied involving undergraduate students who were not science majors, but who were taking at least one science subject at the time of the study. In the current study the participants are grade school and high school students, some of whom are as young as nine years old. Thus, there was a need to simplify the language used in the survey instrument. For example, the items that stated propositions about science teachers in general (e.g., Science teachers strongly encourage students to participate in classroom discussion) were restated to refer to the student's own science teacher and using more simple words and phrases (e.g., "My science teacher wants us to join in classroom discussions"). Other items that used relatively difficult words and sentence construction were simplified. For example, the original item "Science teachers promote the idea of discovering things together with students in their classes" was revised as follows, "My teacher lets us work in groups so that we can discover things together."

Some other items were omitted as they refer to experiences or concepts that would not be found in the basic Philippine basic educational context. For example, the item "Science teachers are more interested in their own research than in teaching students" was removed as grade school and high school science teacher typically do not engage in research. On the other hand, we added some items, which we thought would extend the range of perceptions that could be assessed. Some of the added items were "My teacher asks questions that help me understand my science lesson," "I don't understand the lessons my teacher teaches," and "I feel free to talk about my scientific ideas in class." After removing some original items and adding some new items, the total number of items used in the questionnaires was 56, which is one more than the final version of the PSCS used by Kardash and Wallace (2001).

Procedures

The students answered the questionnaires as part of one of their science classes during the last quarter of the school year, which gives the students enough time to form their perceptions about their science class. The teacher was not present during the administration of the questionnaires and the students were assured that their answers will not be shown to their teachers, school heads, or parents. No personal information was obtained from the students other than their grade level, age, gender, and name.

Results

Overview of the Data Analyses

The data were first analyzed using factor analysis procedures to determine the dimensions of factors of the students' perceptions of their science classes. Once the factors were identified, individual factor scores were computed for each student, and the descriptive statistics were computed for the complete data set, and for the different grade levels and gender groups. The data were then analyzed using separate univariate Analyses of Variance procedures, with the factor score as the dependent variable, and grade level and gender as independent variables, with appropriate post hoc analyses conducted when the main effects were found to be significant.

Factor Analysis

Following the procedures used by Kardash and Wallace (2001), prior to factor analyzing the data, the internal consistency of the 56 item scale was computed. The Cronbach's α = .81, with item-scale correlations ranging from -.38 to .52. There were seven items with negative item-scale correlations and another five items with item-scale correlations below .20. These 12 items were excluded from all further analyses. The internal consistency of the 44 item scale was computed, and the Cronbach's α was .89.

The data from the 44 items were analyzed using principal axis factor analysis to estimate the factorability of the correlation matrix and to determine the appropriate number of factors. The Kaiser-Myer-Olkin measure of sampling adequacy was .95, which suggests that the data set was appropriate for factor analysis. There were six factors that had eigenvalues greater than 1.0, but the scree plot suggests that there were two relatively large factors, and possibly three small ones. We then used principal axis factoring to examine the factor structure of a five-factor solution. The five-factor solution accounted for 34.41% of the variance. The stability of the five-factor solution was further tested by analyzing the data using principal components, maximum likelihood, and generalized least squares extraction procedures. The results across the different extraction techniques found the same items loading on the same factors, suggesting that the five-factor solution was stable.

The five-factor solution resulting from the principal axis factor analysis was then subjected to varimax rotation. Some items had high factor loadings on one factor and also relatively high loading in one or two other factors. To decide which items will be included in the final factors, we set the criterion of loading at least .35 on one factor with a low overlap with any of the other factors (< .25). Using this criterion, only 23 items were retained. The factor loadings, communalities, eigenvalues, and percentage of variance accounted for by each factor are summarized in Table 2.

The seven items that comprise Factor 1 refer to efforts on the part of the teacher to promote student understanding and learning. Generally, they refer to teaching strategies that show concern for student learning; thus we labeled the factor: *Learner-Centered Pedagogy*. This factor is similar to the first factor found in the study of Kardash and Wallace (2001), but the items seem to be more focused. The first factor found by Kardash and Wallace also included items regarding establishing connections among science concepts and other ideas. High scores in Factor 1 can be interpreted as indicating that students perceive their teachers to be practicing strategies that facilitate student learning.

The six items in Factor 2 are also related to practices that encourage student learning. However, they focus on learning activities that encourage inquiry and science-process thinking skills (as opposed to memorization). Therefore, this factor was labeled *Science Inquiry Activities*. Higher scores in Factor 2 indicate that students perceive that

Table 2

Summary of Item Factor Loadings

Items	F1	F2	F3	F4	F5
Factor 1: Learner-Centered Pedagogy					
7. My teacher tries to find out if we understand our past lesson before teaching us a new lesson.	.42				
16. My teacher tells us what facts or concepts are important to learn.	.37				
20. My teacher tries very hard to connect new ideas to past lessons in science.	.40				
27. My teacher asks questions that help me understand my science lesson.	.42				
30. My teacher would try to do everything just to be sure that we understand the ideas taught in class.	.50				
35. My teacher tries hard to make sure students understand the lesson.	.55				
36. It's okay to ask my teacher for help if there are things I don't understand.	.36				
Factor 2: Science Inquiry Activities					
2. My teacher connects new scientific ideas to other science lessons.		.37			
4. I like the laboratory activities in my science class.		.37			
40. My science teacher likes us to make hypothesis and test our theories.		.41			
45. When I grow up, I will take a job that uses a lot of science.		.36			
47. The laboratory activities my teacher gives us are lively and fun.		.42			
56. My teacher lets us do scientific research projects.		.39			
Factor 3: Positive Affect and Beliefs					
14. I don't understand the lessons my teacher teaches. (R)			.49		
17. I am not very good in science that is why I can't understand my science lessons. (R)			.38		
21. The seatworks and laboratory activities in this class are boring.(R)			.54		
43. My teacher is not friendly. (R)			.53		
53. This class is boring. (R)			.611		
55. Science has nothing to do with my life. (R)			.48		
Factor 4: Grades as Feedback					
18. My grades are a good sign of how much I have learned.				.61	
19. My grades in this class are a good sign of how hard I studied in science.				.57	
Factor 5: Support for Self-Learning and Effort					
50. My teacher is more interested in finishing her lesson plan than helping us learn the lesson. (R)					.52
52. Getting high grades in this class depends more on being born intelligent than studying hard. (R)					.45
Eigenvalue	7.97	2.92	1.62	1.45	1.18
Percentage of variance explained	18.10	6.63	3.69	3.30	2.69

their science classes feature activities which involve active inquiry-oriented learning experiences.

Factors 1 and 2 both feature items that are related to positive student learning. On the other hand, the six items in Factor 3 express negative sentiments about the science teacher, learning activities, and the subject matter. However, these items were reversed items, and so the reversed score for the items actually refer to positive sentiments, thus we labeled this factor: *Positive Affects and Beliefs*. These factors indicate an overall positive perception of the learning environment, and are most likely to be associated with a strong motivation to learn and to achieve in science.

The two items in Factor 4 both refer to how the grades obtained by the students accurately reflect the students' levels of learning. The two items comprised two out of the three items in Factor 5 in Kardash and Wallace's (2001) study. We adopted the same factor label used in their study, and thus Factor 4 was labeled *Grades as Feedback*. The factor indicates that students can refer to the results of classroom assessment procedures to determine how well they are learning in class, thus providing a good feedback and monitoring system for their own learning strategies.

The two items in Factor 5 seem to be related to the support and consequences for these learning strategies adopted by students. In particular, the two items expressed a lack of teacher or classroom support for students' pursuit of learning. The first item expresses the lack of concern for helping students learn on the part of teachers, and the second item expresses the perceived irrelevance of the students' own struggle to achieve in class. The two items were actually scored in reverse, and thus the item and factor scores represent the perception that the teacher supports individual students' attempts to learn in the science class. Hence, the factor was labeled *Support for Self-Learning and Effort*.

Putting these five factors together, we can see how different interrelated dimensions of the science classroom environment have been captured in the students' perceptions. Factors 1 and 2 are most closely related as they both relate to the science pedagogy. Factor 1 represents perceptions about the teachers' student-oriented pedagogy; whereas Factor 2 represents learning activities intended to promote science inquiry. Factor 3 represents the affective and motivational dimension of science learning, which is likely to be fostered by Factors 1 and 2. Both Factors 4 and 5 refer to dimensions of the learning environment that support students' learning attempts; as Factor 4 indicates how students are given appropriate feedback through their grades, and Factor 5 indicates how the teacher and classroom supports students' attempts to learn.

Perception of Science Classes as a Function of Grade Level and Age

To explore variations in the students' perceptions of their science classes as a function of the grade level and the students' gender, the mean factor scores for each factor were analyzed in a series of univariate Analyses of Variance with the factor score as dependent variable, and grade level and gender as between group variables. The results of the ANOVA for each factor are presented in the following subsections.

Factor 1: Student-centered pedagogy Generally the students perceived relatively high levels of student-centered pedagogy; the means indicate that student perceive this pedagogy very often. However, is the science classroom perceived to be more or less student-centered as the students' progress in the basic education ladder? The mean scores for Factor 1 across grades 5-10 are summarized in Table 3. The results suggest a slightly increasing trend from grades 5-10. The ANOVA indicates a significant main effect of grade level [F (5, 7873) = 5.06, $p < .0001$]. The trend was analyzed using the Scheffe's test for post hoc comparisons of means, and the results indicate that grade 5 students perceived lower levels of student-centered pedagogy compared to those in grades 8 and 10. Those in grade 8 also report higher levels of student-centered pedagogy compared to those in grades 7 and 9. However, the differences are really too small to be meaningful.

Interestingly, there was also a main effect of gender [F (1, 7873) = 106.26, $p < .0001$]. As shown in Table 3. The female students perceived more student-centered pedagogies compared to their male counterparts. There was no interaction between gender and grade level [F (5, 7873) < 1.0].

Factor 2: Science inquiry activities Compared to Factor 1, the mean perceptions in Factor 2 are lower. Therefore, the students perceive these science inquiry

Table 3

Means for Factor 1 (Learner-Centered Pedagogy) by Level and Gender

	Male		Female		Total	
Level	M	SDE	M	SDE	M	SDE
Grade 5	3.320	.020	3.432	.019	3.379	.015
Grade 6	3.350	.021	3.477	.018	3.422	.015
Grade 7	3.335	.020	3.453	.018	3.401	.013
Grade 8	3.419	.021	3.495	.017	3.465	.013
Grade 9	3.314	.021	3.460	.017	3.400	.013
Grade 10	3.359	.022	3.518	.017	3.459	.012
Total	3.348	.009	3.473	.007	3.421	.006

Table 4

Means for Factor 2 (Science Inquiry Activities) by Level and Gender

	Male		Female		Total	
Level	M	SDE	M	SDE	M	SDE
Grade 5	2.992	.021	3.029	.020	3.012	.015
Grade 6	2.920	.022	2.968	.019	2.947	.015
Grade 7	2.970	.021	3.020	.018	2.998	.014
Grade 8	3.012	.022	2.945	.018	2.971	.013
Grade 9	2.913	.021	2.955	.018	2.937	.014
Grade 10	3.021	.023	3.049	.018	3.039	.014
Total	2.970	.009	2.993	.008	2.983	.006

activities less often. However, like Factor 1, There was also a main effect of grade level on the students' perceptions of the learning activities in their science classes, [F (5, 7873) = 14.22, p < .0001]. The Scheffe's test for post hoc comparisons indicated that the students from grade 5 perceived the highest level of inquiry activities compared to those in grades 6, 8, 9, and 10 (see Table 4). Those in grade 7 also had higher reports compared to those in Grade 9. However, as with Factor 1, the differences were so small to be meaningful.

Unlike in Factor 1, there was no gender effect in the students' perceptions of the learning activities, [F (1, 7873) = 1.92, p > .10], but there was a significant interaction between gender and grade level, [F (5, 7873) = 3.28, p < .006]. There seems to be no gender effect at all in grade 5, but a relatively bigger gender effect in grade 8.

Factor 3: Positive affect and beliefs The students also reported relatively high levels of positive affect and beliefs in their classrooms. There was a significant main effect of grade level [F (5, 7873) = 17.19, p < .0001]. The Scheffe's test for post hoc comparisons indicated that the students from grade 5 reported lower levels of positive affect compared to all the other grade levels (see Table 5). There was also a main effect of gender [F (1, 7873) = 168.84, p < .0001], with the females perceiving higher levels of positive affect and beliefs compared to their male counterparts. There was also a significant interaction between gender and grade level, [F (5, 7873) = 2.63, p < .03]. The males reported much lower levels of positive affect and beliefs in grades 5 to 7, compared to the males in grades 8-10.

Factor 4: Grades as feedback The students also

Table 5
Means for Factor 3 (Positive Affect and Beliefs) by Level and Gender

	Male		Female		Total	
Level	M	SDE	M	SDE	M	SDE
Grade 5	3.163	.021	3.304	.022	3.258	.019
Grade 6	3.304	.022	3.481	.019	3.403	.015
Grade 7	3.270	.021	3.445	.019	3.369	.014
Grade 8	3.355	.022	3.460	.018	3.419	.012
Grade 9	3.301	.022	3.387	.018	3.351	.013
Grade 10	3.315	.024	3.387	.018	3.360	.013
Total	3.282	.010	3.418	.007	3.631	.006

Table 6
Means for Factor 4 (Grades as Feedback) by Level and Gender

	Male		Female		Total	
Level	M	SDE	M	SDE	M	SDE
Grade 5	3.136	.029	3.174	.028	3.156	.020
Grade 6	3.105	.030	3.191	.027	3.153	.021
Grade 7	2.988	.029	3.157	.026	3.083	.020
Grade 8	3.029	.031	3.070	.025	3.054	.019
Grade 9	2.955	.030	3.063	.025	3.019	.020
Grade 10	2.913	.033	2.990	.025	3.961	.020
Total	3.024	.012	3.103	.011	3.070	.008

Table 7
Means for Factor 5 (Support for Self-Learning and Effort) by Level and Gender

	Male		Female		Total	
Level	M	SDE	M	SDE	M	SDE
Grade 5	2.354	.037	2.565	.035	2.466	.026
Grade 6	2.508	.038	2.807	.034	2.676	.027
Grade 7	2.497	.037	2.805	.033	2.671	.025
Grade 8	2.675	.039	3.002	.031	2.875	.024
Grade 9	2.633	.038	2.925	.032	2.805	.025
Grade 10	2.737	.041	3.104	.032	2.967	.025
Total	2.560	.016	2.879	.014	2.745	.011

reported relatively high levels of the accuracy of their grades as feedback for their learning. There was a significant main effect of grade level [F (5, 7869) = 12.81, $p < .0001$]. The Scheffe's test for post hoc comparisons indicated a declining trend (see Table 6). The students in grades 5 and 6 were more likely to perceive that their grades were accurate indicators of their learning compared to those in Grades 9 and 10. There was also a main effect of gender [F (1, 7869) = 22.81, $p < .0001$], with the females reporting their grades as accurate reflections of their learning. There was no significant interaction between gender and grade level, [F (5, 7869) = 1.51, $p > .10$].

Factor 5: Support for self-learning and effort Compared to all other factors, the students registered their lowest scores for the support for self-learning and effort. There was again a significant main effect of grade level [F (5, 7867) = 40.64, $p < .0001$]. The Scheffe's test for post hoc comparisons suggested an increasing trend (see Table 7). The students in grade 5 reported the lowest scores, followed by those in grades 6 and 7, with the highest scores reported by those in grade 10. There was also a main effect of gender [F (1, 7867) = 210.22, $p < .0001$], again with the females perceiving higher levels of a supportive environment for self-learning and effort. There was no significant interaction between gender and grade level, [F (5, 7867) < 1.0].

Discussion

The study was conducted to study Filipino students' perceptions of their science classes in order to explore whether some variables related to teaching may be associated with declining levels of science achievement from elementary to high school and/or with gender differences in science achievement. The results of the study suggest that there are five dimensions of the students' perception that relate to different aspects of the teacher's pedagogy and the learning environment created by the teachers. The dimensions that directly refer to students' perceptions of their teachers' teaching practices are: (a) Factor 1: Learner-Centered Pedagogy, (b) Factor 2: Science Inquiry Activities and (c) Factor 5: Support for Self-Learning and Effort. One factor refers to the science teachers' assessment practices: (d) Factor 4: Grades as Feedback, and one factor relates to how the students perceive the general learning environment and subject matter: (e) Factor 3: Positive Affect and Attitudes, both of which are most likely shaped by the science teachers' practices, too.

The results suggest that students perceive that their teachers' instructional practices are oriented towards helping them learn (Factor 1) but that these practices do not involve enough of inquiry-oriented activities (Factor 2) and do not provide enough support or encouragement for self-directed and effortful learning (Factor 5). There is no clear trend that the use of these learner-centered pedagogies varies across the grade levels. However, the results do suggest that the grade 5 teachers tend to have more inquiry-oriented learning activities compared to their counterparts in the higher grades. On the other hand, support for self-directed and effortful learning increases over the grade levels, with the students in grade 10 reporting the highest levels. It does make sense that science teachers in the higher levels are more likely to encourage more independent work relative to the lower levels.

However, the decline in perceived inquiry-oriented activities suggests the science teachers in the higher grades may not be challenging their students enough to engage in the more complex modes of thinking appropriate for learning science. This result is noteworthy, considering recent efforts to push such activities particularly in the primary grades. A recent report on science education in Europe (Osborne & Dillon, 2008) recommends that the focus of science education for students in basic education should be on engaging students in scientific processes and phenomenon, and that this focus seems to be best achieved through activities that involve extended investigative work, actual experiments, and other forms of inquiry-oriented science activities.

What was most noteworthy was that the students generally reported high levels of positive affect and perception of their science classes, and the trend suggests that the positive affect increases in the higher levels. It seems that the students do not mind that their science classes do not involve the more challenging inquiry-oriented activities. Thus, this issue may not be as major a concern on student engagements as was emphasized in the report on science education in Europe (Osborne & Dillon, 2008).

Interestingly, the students in the higher grades also reported lower perceptions of their grades as appropriate reflections or feedback on their learning and performance (Factor 4). This may suggest any of three things. First, the students in the higher levels may be saying that their grades underestimate their actual science learning. Second, the students may be saying that their grades overestimate their actual science learning. Third, the students may be saying that their grades do not give them good feedback about whether they are learning or not. The data cannot provide a clear interpretation for this trend. However, this result might be the most relevant to understanding the low achievement levels of Filipino students. If students do not feel that their performance in the assessment procedures of their teachers reflect their actual learning, the students may not be fully attaining the curricular goals and still be passing the science subjects. It may be that students are being given credit for successful attainment of science curriculum goals without actually doing so. This would explain the sub-par performance of the science students in the governments' achievement tests in the subject area. Regardless of how this result is interpreted, the problem of ensuring that assessment procedures truly reflect students' learning has been echoed by observations of science education in other parts of the world as well (Osborne & Dillon, 2008).

The female students also consistently reported more positive perceptions (Factors 1, 3, 4, and 5) compared to their male counterparts. These more positive perceptions might explain the trends that indicate some advantage in the science achievement of female students. It is possible that their positive perceptions of the science classroom environment make them more engaged and motivated in their classes. What is interesting is that the girls and boys share the same classroom environment. Are the teachers treating the girls and boys differently? We can only answer this question if we actually observe teacher's behaviors towards their female and male students. Could it be that females have different benchmarks or reference points or schemas that they use in their classroom perceptions? Again, this possibility will require an additional line of inquiry.

There was an interesting interaction effect between gender and grade level in Factor 3: Positive affects and attitudes. The boys reported lower positive affects and attitudes compared to girls in the lower grades, but not so much in the higher grades. It is difficult to conclusively interpret this trend, but it might be worth noting that there is a significant dropout rate from Grade 6 to 7, and anecdotal reports suggest that more boys drop out than girls. The increase in positive affect and attitudes among the boys might be because those who had negative affects and attitudes already left after the intermediate years of study. This is mere speculation but could be the subject of further study in future investigations.

We should emphasize that the study reports students' perceptions, the dimensions of their perceptions, and changes in their perceptions across the school levels. We should not interpret the results as a definitive or accurate description of what truly goes on in Philippine science classes. Science teachers might have different perceptions about the learning activities and environments in science classrooms. Independent observers might have different perceptions, as well. However, as research in other countries indicates (e.g., Seymour & Hewitte, 1997; Strenta et al., 1994) student perceptions can indicate possible factors and processes that contribute to low participation and achievement levels, and also possible areas for reform (Kardash & Wallace, 2001).

Conclusion

The results of the study reveal important dimensions of the science classrooms in the Philippines from the eyes of the students. The perceptions and the trends across grade levels and genders reveal possible explanations to the low achievement levels of Filipino students. Perhaps the most noteworthy result related to the students' perceptions of how the assessment procedures and their grades provide them with feedback about their actual learning in their science subjects. In 2003, the Department of Education raised a level of concern about the quality of the assessment procedures used by teachers, and in fact mandated a revision of the grading procedures. This concern stemmed from an observation – somewhat similar to the students' reported perceptions – that those who pass the subjects based on the schools' assessment system do not seem to demonstrate their true abilities in the national assessment system.

As educational systems aim to improve the design and delivery of science curricula, it might be worthwhile to consider the perceptions of science students. As the current study suggests, there might be rather obvious flaws in the educational process that students themselves readily see.

References

Bernardo, A. B. I. (1998). Do you know where you're going? Global trends in mathematics and science education reform and their implications for Philippine reform efforts. *UP -CIDS Chronicle, 3*(2), 91-100.

Bernardo, A. B. I. (1999). Contemplating a scientific science education reform. *The Manila Journal of Science, 2*(1), 61-63.

Bernardo, A. B. I. (2002). Teachers, the problem of learning, and reform in math and science education. *Ateneo de Zamboanga Journal of Multidisciplinary Studies, 2*(1), 1-20.

Bernardo, A. B. I. (2004). Constructivism, curriculum and the challenges in transforming science education in the Philippines. *Learning Edge, 4,* 1-33.

Golla, E. F., & de Guzman, E. S. (1998). Teacher preparation in science and mathematics education: A situation analysis. In E. B. Ogena & F. G. Brawner (Eds.), *Science education in the Philippines: Challenges for development* (pp. 41-78). Taguig, Metro Manila: NAST, SEI, UP-CIDS.

Kardash, C. A., & Wallace, M. L. (2001). The perception of science classes survey: What undergraduate science reform efforts need to address. *Journal of Educational Psychology, 93*, 199-210.

Martin, M. O., Mullis, I. V. S., Gonzalez, E. J., & Chrostowki, S. J. (2004). *TIMSS 2003 International science report: Findings from IEA's Trends in International Mathematics and Science Study at the eighth and fourth grades.* Chestnut Hill: MA: Boston College. Retrieved March 29, 2007, from http:// timss.bc.edu/timss2003i/scienceD.html.

Nebres, B. F., & Intal, A. M. G. (1998). The challenge of developing science culture in the Philippines. In E. B. Ogena & F. G. Brawner (Eds.), *Science education in the Philippines: Challenges for development* (pp. 29-40). Taguig, Metro Manila: NAST, SEI, UP-CIDS.

Nebres, B. F., & Vistro-Yu, C. P. (1998). A look at organizational structure for an effective delivery of science education. In E. B. Ogena & F. G. Brawner (Eds.), *Science education in the Philippines: Challenges for development* (pp. 151-170). Taguig, Metro Manila: NAST, SEI, UP-CIDS.

Osborne, J., & Dillon, J. (2008). *Science education in Europe: Critical reflections*. London: The Nuffield Foundation.

Seymour, E. (1992). "The problem iceberg" in science, mathematics, and engineering education: Student explanations for high attrition rates. *Journal of College Science Teaching, 21*, 230-238.

Seymour, E. (1995). The loss of women from science, mathematics, and engineering undergraduate majors: An explanatory account. *Science Education, 79*, 437-473.

Seymour, E., & Hewitte, N. M. (1997). *Talking about leaving: Why undergraduates leave the sciences*. Boulder, CO: Westview Press.

Strenta, A. C., Elliot, R., Adair, R., Matier, M., & Scott, J. (1994). Choosing and leaving science in highly selective institutions. *Research in Higher Education, 35*, 513-547.

Tobias, S. (1990). *They're not dumb, they're different: Stalking the second tier*. Tuczon, AZ: Research Corporation.

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