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Practical Intelligence Teaching Approach: Effects on Social Competence and Problem-solving Ability in Biology

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Abstract *- The study focused on Practical Intelligence (PI) Teaching Approach as an intervention in high school biology. Specifically, it sought to determine the effects of the approach on students' practical intelligence in terms of problem-solving skills and social competence. It also tried to establish the relationship between social competence and problem-solving skills.*

Two sections of second year biology students in a private school in Metro Manila were taught by the researcher using the PI Teaching Approach and the conventional approach, respectively for eight weeks during the second quarter of School Year 2008-2009.

Social competence was measured using scenarios which called for socially-oriented responses. Tests measuring problem-solving skills included stressful problem situations that students encounter in their environment.

Findings reveal that the PI Teaching Approach was effective in developing social competence particularly the empathy component and social attributes specifically individual and peer attributes. It is noted, however, that there is no significant difference between the experimental and conventional groups' problem-solving skills, though the experimental group performed much better than the control group in some items in the Critical Incidents Test (CIT) and Real World Test (RWT). Though there was no positive significant relationship between problem-solving ability and social competence, there were positive significant relationships between the CIT and some of the components of social competence, namely, clarity and authenticity. There was also a positive relationship between the RWT and all the components of social competence which include presence, authenticity, clarity and empathy.

Keywords: Practical Intelligence Teaching Approach, social competence, and problem-solving ability

INTRODUCTION

People need all of their skills in good working order to be successful in life. Yet many educational programs focus only in developing people's intelligence in only one area, analytical intelligence, while giving minimal or even no attention to two other areas of intelligence, creative and practical intelligence, that are just as vital to living successfully (Sternberg, 1998).

In their book, *The Bell Curve* (1994), Hernstein and Murray looked into the history of intelligence and class structure in the United States. They found that on the average, various conventional intelligence tests account for only about 10 percent of the variation in various kinds of real-world outcomes. This 10 percent figure implies that IQ-like abilities do matter for life success, but maybe not as much as previously believed. This also shows that a person's other non-IQ abilities are also important. This finding is very important as there are many skilled people who tend to be disenfranchised because although their abilities might be important for job performance, they are not necessarily important for test performance. For example, the creative and practical skills that spell success on the job are not typically measured in the tests used to get into school. As such, society may be overvaluing a fairly narrow range of skills, even if that range

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of skills may not serve individuals particularly well on the job (Sternberg, 1998).

Browsing through educational literature, it could be seen that various instructional approaches and innovations are being developed yearly. However, most of these educational innovations have turned out to be little more than fads (Lochhead and Clement, 1978). Moreover, teachers are often skeptical if these programs will produce superior knowledge or ability. Snow and Lohman (1984) suggested that instructional approaches such as lecture, discussion and role playing be incorporated into the lesson to make instruction effective because not all instructional approaches benefit students in the same way. An important question to ask then is "How does the instructional approach address the problem of improving the thinking skills and strategies of students?"

Statement of the Problem

The study seeks to develop and assess practical intelligence among high school biology students on topics such as genetics and taxonomy.

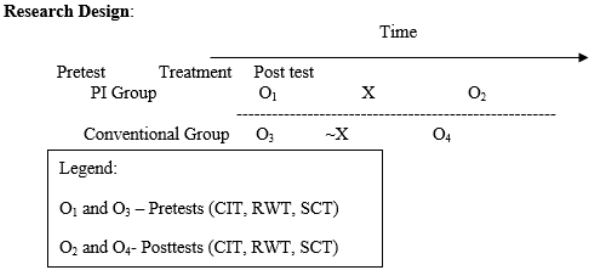
Specifically, the study seeks to answer the following question:

1. Is Practical Intelligence (PI) Approach effective in improving the following:
    a. Problem -solving ability; and
    b. Social competence?

METHODOLOGY

In this section, the research design, the instruments to be used, the description of the research participants and the data collection and analysis procedures are presented.

Research Design:



This is a quasi - experimental study that utilizes the non-equivalent control group. The study is quasi-experimental because it was not possible for the researcher to assign the samples randomly to any group since the groups were already formed and intact even before the treatment (X). The only randomization possible was to assign the intact groups to be anyone of the following groups: PI approach and conventional teaching approach by means of a coin toss. The study utilized a non-equivalent group design because only one group is given the treatment (X) while the other is not (~X). Both treatment and the control groups take the pretest (O_1, O_3) as well as the posttest (O_2, O_4). The CIT, RWT, and SCT serve as the pretests as well as the posttests. The difference between the pretests and posttests in both groups is compared to see if the treatment had an effect on the performance of the group that received it.

The Sample

The research participants consist of eighty-four (90) second year high school students from two intact classes in St Scholastica's Academy of Marikina (SSAM), a private, sectarian and exclusive school for girls run by the Order of St. Benedict sisters. The two classes were randomly assigned treatment by means of a coin toss. The two classes are considered pilot sections and most of the students are of high ability. The researcher is the regular science teacher assigned to these two sections for the School Year 2008-2009.

The researcher gathered data on the students' rank order in the family, performance of household chores, responsibility in class or club

and engagement in sports through the Students Personal Questionnaire (SPQ).This is because the researcher thought this information might affect or influence students' practical intelligence. Students' profile in the different categories was thought to give salient explanations on the result of this study.

Information on the different characteristics of the students such as rank order in the family, performance of household chores, responsibility in the class or club and engagement in sports are presented in the succeeding table.

Table 3
Student responses in selected items from the Student's Personal Questionnaire

SPQ Item	Category	Conventional Approach Group		PI Approach Group		Total	
		N	%	N	%	N	%
Rank Order in the Family	1st	24	50.00%	24	50.00%	48	50.53
	Middle	10	20.83%	14	29.16%	24	25.26
	Last	12	25.00%	6	12.50%	18	18.95
	Only	2	4.16%	2	4.16%	4	4.21
Performance of Household Chores	Yes	43	89.58%	35	77.77%	78	82.11
	No	5	10.42%	11	22.91%	16	16.84
Responsibility in Class/Club	Officer	10	20.83%	12	25.00%	22	23.16
	Non-Officer	38	79.16%	34	70.83%	72	75.79
Engagement in Sports	Yes	31	64.58%	29	60.41%	60	63.16
	No	17	35.41	17	35.41%	34	35.79

It could be seen from Table 4 that 48 or half of the students (50.53%) rank 1st among the siblings in the family, 24 (25.26%) are middle child, 18 (18.95%) are youngest child and 4 (4.21%) are only child. Most of the students (82.21%) do household chores while 16 (16.84%) do not do household chores. Twenty-two (23.16%) of the students are class or club officers while most of them (72 or 75.79%) are not officers. Majority (60 or 63.16%) of the students are engaged in sports while 34 (35.79%) are not engaged in sports. These data mean that the research participants are not really exposed to doing or exercising practical tasks than when they are actively engaged in sports or take an office in the class or club.

Majority of the students fall under the 1st and middle child category. According to them, their parents did not expect them to be contributing a lot when it comes to doing household chores since they have maids in the house. Their parents pampered them and made them feel they are a blessing from God but despite this, most of them still do household chores but not on a daily basis. In taking responsibility in the club, only a few hold a position or office.

According to them, they wanted to focus more in the academics since holding a position in any organization is demanding of time and effort hence, less social and interpersonal skills were developed in them. With regards to engagement to sports, most of them are playing games but not on a regular basis. Most of the time, they play with their family members or close friends.

Information gathered from the SPQ questionnaire was necessary as they led explanations to various aspects of the study. These are practical skills necessary for daily life and the skills' development level could seriously promote or hamper our successful adaptat`ion in the surrounding material or social environment (Malgozata, Berzina, 2000).

Students from both groups had almost the same profile in terms of SPQ items such as rank order in the family, performance of household chores, responsibility in class or club and engagement to sports. It came out that the research participants are not really practically oriented.

The Instruments

The researcher designed several practical intelligent tests for this study that were used to gather quantitative as well as qualitative data. The instruments that were used are as follows:

Practical Intelligence Tests (PITs)

This instrument is researcher-made and is composed of two parts namely, the social competence test (SCT) and the problem solving ability tests, CIT and RWT. These tests were used to measure students' ability to deal with real-life problems and situations. The description of each component is as follows:

1. Social Competence Tests (SCTs)

This instrument is used to gauge students' abilities to adapt to or to shape their environment. It is divided into two components: Social Competence Test (SCT), and Social Attributes Checklist (SAC)

1.A. Social Competence Test

SCT is a paper-and-pencil test designed to measure judgment in work settings, usually by describing a scenario and having the respondent identify their appropriate responses (McDaniel *et al*., 2001). Since the PI approach is geared towards activities which involve more social and group interactions, possible scenarios will be developed and written to represent important, relevant, and challenging interactions. The response alternatives are analyzed based on the dimensions of social intelligence such as Situational Awareness, Presence, Authenticity, Clarity and Empathy (SPACE).

1.B. The Social Attributes Checklist

This instrument is based on Eric Digest website's *Social Attribute's Checklist*. The checklist is intended as one of a variety of ways to measure the social well-being of children. This checklist is used by the researcher in order to observe changes in the social structure of both groups. How children act toward and are treated by their classmates (cooperatively or aggressively, helpfully or demandingly, *etc*.) appears to have a substantial impact on the relationships they develop (Ladd, 2000). The test is divided into three parts namely, individual attributes, social skills attributes and peer relationship attributes. Likert scale will be used by the teacher to rate student's behavior in each category: Individual Attributes, Social Skills Attributes and Peer Relationship Attributes

2. Problem- Solving Ability Test (PSAT)

The Practical Problem- Solving Test is a written problem -solving test and rubric for assessing problem solving skills. This researcher-made test presents a real-world issue to the student that is directly relevant to the application of material the student is learning in the course. Students answer a series of questions about the causes, consequences and solutions from a problem that arises from the issue. It is divided into **two parts**: Everyday problem-solving ability which deals with possible case scenarios they may encounter in their science class, and real-world problem -solving ability in which critical

incidents and stressful situations are presented for them to solve.

Treatment

The Conventional Group

The conventional group was taught using the traditional lecture-discussion method. After each session, students were given assignments consisting of questions to be answered. These assignments may be answered before the discussion or incorporated into the discussion. The topics to be covered weekly were similar for both groups. Administration of tests was done during the same day and monitored by the same teacher-researcher.

The PI Approach Group

The designs of the lessons for the PI group follow a format based on the four-prong model of Sternberg and Davidson (1989). This model draws upon Vygotsky's (1978) idea that learning is most effective when it occurs first in a social context and is only internalized later.

In this approach, the teacher provides lessons that describe the global purpose of the lesson and give the underlying theory or rationale for teaching it. The objectives and time planner help the teacher become quickly aware of the specific skills to be taught and the timing of the lesson. Information concerning prerequisite skills, an estimate of the amount of time needed for the lesson, and the necessary materials facilitate preparation.

The teacher starts out by giving students an orientation to the concept being taught. First, the teacher taps the students' prior knowledge, which gives the teacher an opportunity to correct incorrect information and a chance to see the way students have learned to think about the topic. The teacher presents new information via lecture, discussion, questionnaires, and the text.

Students then meet in small groups to try to apply their new knowledge and skills. This part of the lesson includes games, activities and work sheets. It allows for greater variety in the lessons, creating a sense that "something new may happen" in the Practical Intelligence" class. Afterwards, students evaluate their use of the new knowledge or skill. They also critique their work and the material being taught.

Finally, the teacher provides integration activities that encourage the students to apply their new knowledge in their own lives. These activities are intended to help bring about the transfer of the new knowledge or skills to situations other than school.

The researcher also integrates additional activities that may enhance students' practical intelligence such as:

- more exposure to laboratory work focus on the practical application of the processes learned
- inclusion of real-life problem solving, stressful situation or critical incident tasks.

Preparing the Classes for the Study

The day before the administration of the pretests, the students in the PI group were first oriented regarding the topics to be covered as well as some of the planned activities. The necessary classroom preparations for the entire duration of the study period were also done during this time. The teacher-researcher decided to teach both the PI and conventional groups for two reasons: (1) the training of another teacher on the rationale and implementation of the various teaching strategies to be used in the study would take a considerable amount of time and (2) correct implementation of the teaching strategies must be ensured in order to maintain a clear distinction between the PI approach and the conventional approach. To minimize or eliminate possible researcher bias, the teacher-researcher asked one of the regular science teachers and the assistant principal to observe the teacher-researcher during the treatment period.

Initial Administration of Tests

The pretests (CIT, RWT and SCT) were administered on the second day of the study, one day before the start of the treatment which was on September 1, 2008.

The Subject Matter Content and Lesson Schedule

The lessons that were included in this study were Genetics and Taxonomy. During the treatment period, the students were not informed that they were participating in a study. The students have biology classes from Monday to Friday. The conventional group and the PI group have different times for Biology each day.

Final Administration of Tests

After eight weeks of treatment, the post-tests (CIT, RWT, and SCT) were administered to both the experimental and control groups. Just like in the pretest, the administration of the posttest took only one day. The date of administration of the posttest was on October 23, 2008.

Data Analysis

The CIT, RWT, and SCT pretests and posttests were subjected to descriptive and inferential statistics.

Descriptive statistics were used to describe the profile of the students in both groups. The data gathered in the CIT, RWT, and SCT were then tabulated and the frequencies obtained. The mean and the standard deviation values of the two groups were also calculated for social competence (from SCT), practical problem-solving abilities (from the CIT and RWT).

Inferential statistics were used to compare between and within groups' performance and to test the hypotheses. Test of significance or Chi square were used to determine whether the difference in the frequencies/percentages of data shown by the CIT, RWT, and SCT are significant. The t- test for paired samples was used to determine if there are any changes in the CIT, RWT, and SCT pretests and posttests scores. Pearson's product-moment correlation was used to find out if there are relationships among social competence and problem-solving ability. All the statistical tests were done using Microsoft Excel and Statistical Packages Software Suite (SPSS) version 16.

RESULTS AND DISCUSSION

Findings from the study warepresented, analyzed, and interpreted. This presentation consists of sections focusing on: (1) determining the initial comparability of groups using the students' first quarter grade, (2) comparison of pretest, posttest and gain scores of the groups in the Critical Incidents Test (CIT), Real-World Test (RWT) and Social Competence Test (SCT), (3) comparison of student performance based on the Social Attributes Scale (SAS) before and after the treatment as well as (4) correlation of posttest scores in the CIT, RWT, SCT and the SAS.

Comparability of Groups

First Quarter Grade (FQG)

The mean, standard deviations and result of an independent samples *t*-test in the first quarter grade of the students in the two groups are presented in Table 4.

Table 4

Independent samples t–test for students' first quarter grade

Teaching Approach	N	Mean	SD	df	t ratio	Sig.
Practical Intelligence (PI)Approach	45	84.56	3.940	89	.298	.766
Conventional Approach	46	84.33	3.393			

No significant difference was found in the first quarter grade of the conventional group and the PI Approach group. This means that the students from both groups were comparable in terms of academic achievement. This was because both classes were composed of semi-homogeneously high-achieving students with the

same number of honor students. Both groups were observed to be well-disciplined and well-behaved by their teachers. Generally, the students were predisposed to learning new things everyday.

The teacher was very comfortable in teaching the PI Approach group and had no difficulty in making them participate in the daily activities. The students easily adjusted to the treatment with them developing a mindset with the expectation that "There will be something new that will happen each day". There was no apprehension on the part of the researcher about any possible negative changes on students' disposition and attitude about the subject. Based on the students' behavior and responses, it was clear that they were open-minded as they did and analyzed things practically.

The conventional group was also composed of high-achieving students. For the entire duration of the study, the lessons and activities prepared for them were well participated and appreciated though sometimes, they would clamor for more hands-on activities and group work. There were some instances where in they felt uncomfortable that the other group was doing a different set of activities but it was made clear to them that there are different ways to understand the lesson. Despite this observation, the control group did not lose enthusiasm and interest in learning the lessons. This may be accountable for their proper disposition and perception to learning new things.

Problem-Solving Ability

The study was conducted in an exclusive-for-girls school. Most of the students had been enrolled in the institution since preparatory years. The students are limited to interacting with mostly female students and administrators and a few male staff and maintenance members. There is a claim that gender has a relationship with problem- solving ability. According to Wang (2007) masculine orientation, but not feminine orientation, was statistically significantly associated with problem-solving ability, as measured by the dimension of rational problem solving. Bem (1974) defined masculinity as associated with instrumentality, and femininity as associated with expressiveness; thus, masculine traits are more behaviorally referenced and problem focused than feminine traits.

In the context of this study, problem-solving ability means the ability to construct a solution based from experience or hunch enabling the application of a preferred mode of problem solving.

In measuring the problem-solving ability of the students, two tests were administered namely, CIT and RWT wherein situational descriptions are provided. In the CIT, critical incidents on the application of genetics in the society (morality issues), the government and counseling are included. In the RWT, common science-class related incidents are given from which the students reflect their problem-solving ability that was not taught in school nor read in a textbook.

The Critical Incidents Test is the first type of test administered to measure the practical problem-solving skills of the students. In this test, the students examined some critical incidents issues and chose the most appropriate response or solution so solve the problems.

The independent samples *t*-test for the PI Approach group and conventional group in the CIT are presented in Table 5.

Table 5
Independent samples t-test for CIT pretest, posttest and gain scores

Measure	Group	Mean	SD	df	t ratio	Sig.
Pretest	PI Approach	20.44	2.760	89	-.890	.376
	Conventional	20.91	2.239			
Posttest	PI Approach	20.44	2.659	89	-1.23	.221

	Conventional	21.15	2.812			
Gain	PI Approach	.00	3.169	89	-.350	.727
	Conventional	.24	3.335			

Based on Table 5, no significant differences were found in the pretest score between groups. Both groups performed similarly in the CIT pretest and posttest with only a slight gain for the conventional group in the posttest.

The comparison of the pretest and the posttest scores of the PI Approach group and the conventional group in the CIT are presented in Table 6.

Table 6
Related samples t-tests for pretest and posttest scores in the CIT

Group	**CIT Pretest**	**CIT Posttest**	**Df**	**t ratio**	**Sig**
	Mean	**Mean**			
PI Approach	20.44	20.44	44	.000	1.000
Conventional	20.91	21.15	45	.486	.629

No significant difference was found in the scores of the two groups though the conventional group had a slightly higher mean posttest score (Table 5). The number of students who scored highly in the CIT (20 points and above) was also roughly equal for the two groups (conventional: 36, PI Approach: 33) as well as the number of students who had positive gains (conventional: 21, PI Approach: 19).

This result could be explained by the decreased implementation of inductive reasoning which is said to produce the transfer of skill to every problem solving (Ball *et al.*, 2002). The PI Approach group was given more leeway in formulating their solutions to problems in any desired way and their experimentations are not totally structured. In the conventional group, inductive reasoning was used by the teacher during discussions. However, it came out that the teacher did most of the talking and fewer students were reciting as less hands-on and practical activities were given.

The conventional group however scored higher in the test. This could be explained by the fact that they were given more exposure to activities which involved inductive reasoning like graded recitation and structured experiments.

In Table 7, the scores of the PI group and the conventional group in the particular items of the CIT are presented. The items in the CIT take into account the relevance of genetics in different aspects to see whether the PI group and conventional group differ in their answers. Analysis of their scores for each aspect was done.

Table 7
Item Analysis for pretest and posttest scores in the CIT

Content	**Item Number**	**PI Approach**		**Diff**	**Conventional Approach**		**Diff**
		Pretest	Posttest		Pretest	Posttest	
Genetics	1	3.56	3.62	0.06	3.69	3.60	-0.09

and the Society (Morality Issues)	6	3.50	3.36	-0.14	3.37	3.42	0.05
Genetics and Government Policies	2	3.30	3.19	-0.11	3.46	3.40	-0.04
	4	2.93	3.26	0.33	2.99	3.21	0.22
Genetics and Counseling	3	3.28	3.30	0.02	3.69	3.60	-0.09
	5	3.41	3.68	0.27	3.70	3.77	0.07

It could be seen from the table that the PI Approach group had a positive increase in the total mean score in the items, which pertain to Genetics and Government Policies (Items No. 2 and 4) and Genetics and Counseling (No.3 and 5). For the items Genetics and the Society (Items No. 1and 6), both the PI Approach and conventional groups had a decrease in the total mean scores. The PI Approach group scored high because part of the approach included more activities linking the lesson to daily life and identifying the significance of the lesson to the real world. Both groups increased in their scores in all items except for the items about genetics and the society. In the items concerning genetics and society, questions included morality aspects, which the students may not yet be critical of.

In Table 8, the scores of the two groups in the different items of the CIT in the posttest as well as their gain scores are compared.

Table 8

Item Analysis of Posttest and Gain Scores in the CIT

Measure	Content	Item Number	Group	Mean	t-ratio	df	sig
Posttest	Genetics and the Society	1	PI Approach	3.69	-.056	89	.955
			Conventional	3.70			
		6	PI Approach	3.33	-.181	89	.856
			Conventional	3.37			
	Genetics and Counseling	3	PI Approach	3.22	-2.277	89	**.025**
			Conventional	3.70			
		5	PI Approach	3.67	-.374	89	.710
			Conventional	3.72			
	Genetics and Government Policies	2	PI Approach	3.20	-1.270	89	.207
			Conventional	3.46			
		4	PI Approach	3.27	1.532	89	.129
			Conventional	2.98			
Gain		1	PI Approach	.04	.127	89	.899

	Genetics and the Society		Conventional	.02			
		6	PI Approach	-.24	-.831	89	.408
			Conventional	-.02			
	Genetics and Counseling	3	PI Approach	-.13	-.902	89	.370
			Conventional	.09			
		5	PI Approach	.18	1.097	89	.276
			Conventional	-.07			
	Genetics and Government Policies	2	PI Approach	-.18	-.956	89	.342
			Conventional	.04			
		4	PI Approach	.27	2.122	89	**.037**
			Conventional	-.30			

Students from the PI Approach were relatively more actively engaged in classroom activities especially in recitation. Since practical applications, stressful incidents scenarios and real-world situations (in Genetics) like GMOs, genetic counseling, gene therapy, and others are presented and are given importance in the approach, students are less likely to be hesitant to speak their minds. Over-all, students in the upper-grade bracket participated more often because they find it less difficult to explain the concepts in their own words or they find it easier to translate concepts into words. Usually, discussions become lengthy that it exceeded the allotted time because more students would like to recite. Students from the experimental group reason out with pragmatic considerations in making decisions (*e.g.* examining advantages and disadvantages). On the other hand, there were only a few students from the control group who constantly recited. This may be due to their difficulty to apply or link concepts into their lives since they were only given a limited number of practical works. Also, most students who were reciting came from the upper-grade bracket.

The Real-World Test is the second type of test administered to measure the practical problem-solving skills of the students. The test is composed of common scenarios that high school students experience or encounter in a typical science class such as experimentations, working and communicating with the teachers and group leaders, maintaining discipline and cooperation among the group members and dealing with difficult situations.

In Tables 9 and 10, the independent and related samples t-test for the PI Approach group and conventional group in the RWT are presented.

Table 9
Independent samples t-test for RWT pretest, posttest and gain scores

Measure	**Group**	**Mean**	**SD**	**df**	**t ratio**	**Sig.**
Pretest	PI Approach	3.58	1.357	89	-1.399	.165
	Conventional	3.93	1.063			
Posttest	PI Approach	3.96	1.127	89	-.847	.399
	Conventional	4.17	1.322			
Gain	PI Approach	.38	1.614	89	.454	.651
	Conventional	.24	1.286			

From Table 9, it can be seen that there are no significant differences found in the pretest and posttest scores between groups. Both groups performed similarly in the RWT pretest and posttest with the PI Approach group having a

numerically higher gain. It was observed that the PI Approach group had a better grasp of how it is to connect or communicate with people at least within their group. Due to this, the students became more efficient in doing practical tasks as seen in their performance in laboratory activities and their enthusiasm in doing things practically. Also, it was observed that the PI Approach group considered the practical value of things as reflected in their attitudes (recycling of bottles and scrap materials in the lab) and in the recitation where they sounded the pragmatic considerations in making decisions.

Table 10
Related samples t-tests for pretest and posttest scores in the RWT

Group	RWT Pretest Mean	RWT Posttest Mean	df	*t* ratio	Sig
PI Approach	3.58	3.96	44	1.570	.123
Conventional	3.93	4.17	45	1.262	.214

No significant difference was found in the scores of the two groups though the conventional group had a slightly higher mean posttest score (Table 10). The PI Approach group had a greater gain in their posttest scores though the result was not statistically significant. Thirteen (13) students in the experimental group had a score of 5 and above in the RWT while 19 had a score of 5 and above in the control group. About 49% (22 students) had positive gains for the PI Approach while 34.8% (16 students) had positive gains for the conventional group.

Item analysis of the RWT was also done. The PI Approach had a significant increase in their score from the pretest to the posttest on item 3 (t = 2.458, d.f. = 44) while no significant increase was noted for the conventional group. In Table 11, the mean score of the two groups per each item as well as their gains are compared.

Table 11
Item Analysis of Posttest and Gain Scores in the RWT

Measure	Item Number	Group	Mean	t-ratio	df	sig
Posttest	1	PI Approach	4.44	-.542	89	.589
		Conventional	4.61			
	2	PI Approach	3.71	-2.244	89	**.027**
		Conventional	4.22			
	3	PI Approach	4.20	1.264	89	.210
		Conventional	3.87			
	4	PI Approach	4.38	-.137	89	.891
		Conventional	4.41			
	5	PI Approach	4.00	.730	89	.467
		Conventional	3.72			
	6	PI Approach	3.93	.767	89	.445
		Conventional	3.70			
	7	PI Approach	3.76	-.379	89	.706
		Conventional	3.85			
	8	PI Approach	3.82	1.263	89	.210
		Conventional	3.48			
Gain	1	PI Approach	.40	.653	89	.516
		Conventional	.11			
	2	PI Approach	.16	.012	89	.990
		Conventional	.15			
	3	PI Approach	.53	1.419	89	.159
		Conventional	.04			
	4	PI Approach	.02	.482	89	.631
		Conventional	-.11			
	5	PI Approach	.02	.968	89	.336
		Conventional	-.37			
	6	PI Approach	.09	.435	89	.665
		Conventional	-.09			
	7	PI Approach	-.22	-.877	89	.383
		Conventional	.02			
	8	PI Approach	.20	2.057	89	**.043**
		Conventional	-.35			

From Table 11, it can be seen that the PI Approach group and the conventional group only significantly differ in item 2 with the conventional group having a higher score while in terms of gain, the PI approach had a significantly higher gain in item 8.

Most of the students from the PI Approach were enthusiastic about the lessons and the activities. Since students enjoy hands-on activities, they tend to get excited with these activities and finish their output ahead of time. Because of this, some students did extra or volunteer work or tasks like solving more genetics problems, fixing the chairs, picking up trashes, erasing the writings on the board and cleaning the laboratory tables and even recycling

trashes in the lab (pragmatic valuing). It was surprising that the experimental group has the lesser number of students who are of class/club officer and in terms of number of students who perform household chores compared to the control group.

At some cases, students would ask relevant questions about how the lesson applies to their families and communities or to other persons they know. They seemed to enjoy exploring further the topics or concepts learned and how useful these are to their lives. On the other hand, the conventional group showed less enthusiasm as it is in the PI Approach group though there was no incident wherein the class lost interest in the subject. They still were very attentive and curious.

Social Competence

Social competence can also be affected by the social context and the extent to which there is a good match between the child's skills, interests, and abilities and those of peers. Socially competent person is able to select and control which behaviors to emit and which to suppress in any given context, to achieve any given objective set by themselves or prescribed by others. A child's social competence depends upon a number of factors including the child's social skills, social awareness, and self-confidence. Social skills describe the child's knowledge of and ability to use a variety of social behaviors that are appropriate to a given interpersonal situation and that are pleasing to others in each situation. Children who have a wide repertoire of social skills and who are socially aware and perceptive are likely to be socially competent (Barab & Plucker, 2002)._Similarly, socially incompetent children are often more interested in "getting even" with peers for injustices than they are in finding positive solutions to social problems and expect that aggressive, coercive strategies will lead to desired outcomes.

In this study, social competence was measured using two instruments namely, SCT and SAS. The SCT is composed if different situations in which the students may find problematic or difficult to deal with. They are asked to give their own responses which they think are socially effective in dealing with the situations. The responses of the students are analyzed with corresponding classification under the categories S-situational awareness, A-authenticity P- presence C- Clarity and E-empathy. The SAC is an observational checklist that measures students' personal, social and peer attributes at the start and at the end of the study.

In Tables 12 and 13, the independent and related samples t-test for the PI Group and Conventional Group in the SCT are presented

Table 12
Independent samples t-test for SCT pretest, posttest and gain scores

Measure	Group	Mean	SD	df	t ratio	Sig.
Pretest	PI Approach Group	39.31	5.783	89	.284	.777
	Conventional Approach Group	38.93	6.820			
Posttest	PI Approach Group	41.04	4.311	89	1.733	.087
	Conventional Approach Group	39.11	6.162			
Gain	PI Approach Group	1.73	6.837	89	.910	.366
	Conventional Approach Group	.17	9.303			

Looking at the result, no significant differences were found in the pretest score between groups (Table 12). The experimental group had a slightly higher posttest score (41.04) than the control group (39.11). In terms of gain scores, the PI Approach group had much higher scores (1.73) than the conventional group (.17).

Table 13

Related samples t-tests for pretest and posttest scores in the SCT

Group	SCT Pretest Mean	SCT Posttest Mean	df	t ratio	Sig
PI Approach	39.31	41.04	44	1.701	.096
Conventional Approach	38.93	39.11	45	.127	.900

Comparing the pretest and posttest scores, no significant difference was found between the two groups although the posttest score of the PI Approach group was higher than that of the conventional group.

In Table 13, the scores of the PI Group and Conventional group in the selected items corresponding to the different components of social competence are shown while in Table 14, their scores in the different items and components are compared.

Table 14
Summary of pretest and posttest mean scores in the SCT components

Component	Item	PI Approach Group			Conventional Approach Group		
		Pretest	Posttest	Gain	Pretest	Posttest	Gain
Presence, ***P***	4	4.36	4.40	0.04	4.50	4.44	-0.06
	9	3.96	4.11	0.15	3.74	3.98	0.51
				Total gain: **0.19**	Total gain:		**0.46**
Authenticity, ***A***	8	3.80	3.68	-0.12	3.72	3.92	0.20
				Total gain:- **0.12**	Total gain:		**0.66**
Clarity, ***C***	1	3.53	3.53	0	3.48	3.96	0.48
	5	3.73	3.83	0.10	3.87	3.46	-0.41
				Total gain: **0.10**	Total gain:		**0.07**
Empathy, ***E***	2	3.89	4.02	0.13	3.83	4.33	0.50
	3	4.02	4.23	0.21	3.85	3.31	-0.54
	6	3.82	3.89	0.07	3.74	3.52	-0.22
	7	4.62	4.62	0	4.43	4.46	0.03

	10	3.58	4.05	0.47	3.78	4.02	0.24
				Total gain: **0.88**	Total gain:		**0.01**
Summary of Total gain scores				**2.19**			**1.00**

**There is no item for S (Situational Awareness)*

Based on the table, the PI Approach group had a higher gain in all the components of the SCT (C=0.19, A=0.12, C=0.10 and E= 0.88) which is 2.19 while in the PI Approach, there was also a total increase of 1.00. It could be seen that the PI Approach group had the highest gain in Empathy, *E* component (0.88) and lowest in Clarity, *C* (0.10). In the conventional group, the highest gain is from Authenticity, *A* component and lowest in Empathy, *E*. It could be said that in the social competence test, it is the *empathic* component that was most developed in the PI Approach, at the least was *clarity*.

Empathy is the skill of building connections with people - the capacity to get people to meet you on a personal level of respect and willingness to cooperate. Empathy, in this case, goes beyond the conventional definition of having a feeling toward another person; here, it means creating a mutual feeling between yourself and another person (Dr. Karl Albrecht, 2004).

Students became more emphatic and sensitive of other's needs and feelings. Because of this, they were able to establish good working relationship among the members in the group which in return gave them beneficial effects in their academic achievement in Biology (successful adaptation). This may be accounted with the school's social involvement programs wherein students experience immersion with the out-of-school youth, poor families, home for the aged and orphanages.

In the PI Approach group, the items concerning empathy had the highest gain score and lowest in clarity while it is the authenticity aspect in the conventional group with the highest gain score as contrast to empathy. It can be said that the conventional group are more assertive of their feelings even without thinking of the possible consequences it might lead them so long as they are able to express their sentiments. They are also less emphatic as they tend to think concentrate or focus on themselves alone ("self-survival").

In both responses, it was observed that students tend to become impulsive and outright with things that they want to say without considering the manner or approach on how they say things to other party. They are more interested in "getting even" with peers for injustices than they are in finding positive solutions to social problems and expect that aggressive, coercive strategies will lead to desired outcomes.

Their total SPACE score is not representative of their scores for each SPACE component. Therefore they were separately analyzed in the table below.

Table 15
Independent samples t-test for SCT items

Measure/Component	Group	Mean Posttest	df	*t –ratio*	sig
Item 1 (Clarity)	PI Approach	3.44	89	-1.863	.066
	Conventional	3.96			
Item 2 (Empathy)	PI Approach	4.00	89	-1.241	.218
	Conventional	4.30			
Item 3 (Empathy)	PI Approach	4.22	89	3.710	.000
	Conventional	3.24			
Item 4 (Presence)	PI Approach	4.38	89	-.143	.887
	Conventional	4.41			
Item 5 (Clarity)	PI Approach	3.76	89	.830	.409
	Conventional	3.48			
Item 6 (Empathy)	PI Approach	3.93	89	2.165	.033
	Conventional	3.46			
Item 7 (Empathy)	PI Approach	4.53	89	.266	.791
	Conventional	4.48			
Item 8 (Authenticity)	PI Approach	3.64	89	-1.036	.303
	Conventional	3.91			
Item 9 (Presence)	PI Approach	4.18	89	.637	.526
	Conventional	4.02			
Item 10 (Empathy)	PI Approach	4.16	89	.758	.451
	Conventional	3.98			
Presence	PI Approach	8.56	89	.343	.732
	Conventional	8.43			
Authenticity	PI Approach	3.64	89	-1.036	.303
	Conventional	3.91			
Clarity	PI Approach	7.20	89	-.504	.615
	Conventional	7.43			
Empathy	PI Approach	20.84	89	2.192	.031
	Conventional	19.46			

It could be seen from the table that at the score of 1.662 for degrees of freedom of 89, the differences of the control and experimental groups is significant at 95% confidence interval in the following items: 3 (3.710 and 3.719), 6 (2.165 and 2.174) and E for Empathy (2.192 and 2.195). It was observed that the items where a significant changes were seen were pertaining to students' confrontational and advising styles and approaches (item 1-advising a friend, item 3-dealing with an irresponsible group mate, item 6-confronting detractors and for the SCT dimensions it is the item for Empathy- talking with uncooperative group members). It was mentioned earlier that students from both groups scored high in genetics and counseling. This is consistent with item 1, 3 and 6 where their skills on counseling and advising a friend significantly changed.

It is clear that students gained styles and skills on how to deal with difficult situations at least in the areas mentioned where significant changes were seen. It could be said that with regards to handling such cases, students were able to improve.

Conclusion and Recommendation

The Practical Intelligence Teaching approach is effective in improving social competence particularly empathy as well as social attributes of students. It is as effective as the conventional approach in developing problem-solving skills though the PI group performed much better than the conventional group in some items in the Critical Incident Test.

Teachers should use more practical task-based approaches in their classrooms since they could help improve the students' social competence specifically empathy. They should also provide simple experiments using everyday materials to help students appreciate the pragmatic value of things. They should also emphasize to the students the importance of having good relationship among and between the groups for it fosters positive learning in class.

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