International Journal of Arts & Sciences,
CD-ROM. ISSN: 1944-6934 :: 5(5):573–583 (2012)

THE EFFECTS OF PERSONALIZED INSTRUCTION ON THE ACADEMIC ACHIEVEMENT OF STUDENTS IN PHYSICS

Romiro G. Bautista

AMA International University – Bahrain, Kingdom of Bahrain

This study presents the superiority of personalized instruction as an innovative method of college teaching as a response to the threshold of the 21st century that leads educationists to convert the traditional classroom initiatives to contemporary initiatives that make the classroom learning situations more dynamic. One of these initiatives is personalizing the instruction. In this study, it elaborates the articulation of the contemporary initiatives in a dynamic classroom environment. It focuses on learning the history of learners including their learning styles, and the culture of collegiality in the learning environment. It presents the constructivists environment as a mitigating factor in the development of a sound culture of learning and development in the course; the role of collaborative learning making it interactive and cooperative to learners in a shared culture of active learning experiences through small group discussion (SGD), teacher-coach-adviser and peer-mentor, and an implementation of flexible scheduling and pacing using authentic assessment of student learning. It found out the students exposed in the personalized instruction performed better in their post-test mean score. Concomitant to that finding is the significant interaction of this methodology with learning abilities of the students. However, there is no significant difference on the scores attained by the students across their learning abilities. Furthermore, it was found out that the low and average students benefited most in the program. Hence, the program is recommended in helping students to cope with their learning inabilities.

Keywords: Personalized instruction, Academic achievement, Cooperative learning, Modular instruction, Constructive learning environment.

Introduction

The eve of the 21st century is the threshold that leads educationists to divert from the traditional classroom initiatives to contemporary initiatives that make the classroom learning situations more dynamic. One of these initiatives is personalizing the instruction.

Personalization of instruction and learning is the effort on the part of a school to take into account individual student characteristics and needs, and flexible instructional practices, in organizing the learning environment. Teachers committed to personalizing instruction help their students develop personal learning plans, assist in diagnosing their cognitive strengths and weaknesses and other style characteristics, help adapt the learning environment and instruction to learners' needs and interests, and mentor authentic and reflective learning experiences for their students (Keefe and Jenkins, 2000, as cited in http://www.lecforum.org/pi.htm).

Concomitantly, students' search for understanding motivates them to learn better. When students want to know more about an idea, a topic, or an entire discipline, they put more cognitive energy into classroom investigations and discussions and study more on their own (Brooks and Brooks, 1999). Thus, the elements of the teaching-learning process must be flexible yet interactive in a constructive learning environment.

The success of the teaching-learning process depends on the input given by the teacher, the student and the learning environment. Iquin (1993) and Bautista (2005) claimed that the new type of teaching materials as well as new classroom procedures call for an alert type of the teacher whose role includes a follow up of the learning made by his students.

In view of the foregoing, this study elaborates the articulation of the contemporary initiatives in a dynamic classroom environment. It focuses on learning the history of learners including their learning styles, and the culture of collegiality in the learning environment. It presents the constructive learning environment as a mitigating factor in the development of a sound culture of learning and development in the course; the role of collaborative learning making it interactive and cooperative to learners in a shared culture of active learning experiences through small group discussion (SGD), teacher-coach-adviser and peer-mentor, and an implementation of flexible scheduling and pacing using authentic assessment of student learning (Jenkins and Keefe: 2005; Smutny: 2003; Nordlund; 2003; Jasmin: 2005; Bautista: 2005).

It is in this context that the teacher's role in facilitating learning is significantly desirable because a teacher who is aware of his role in the teaching-learning process does not only depend on the printed words in books. Rather, he designs his own activities and supplementary materials. He is expected to equip his students with instructional materials that contain the most effective and constructive ways to develop skills and enrich their learning (Bautista, 2008).

This study also covers the elaboration of modular instruction and cooperative learning in a constructive learning environment as means of personalizing Physics instruction considering that the learners are the center of any educative processes. Tan (1993) in Obedoza (2002) and Bautista (2005) emphasized that learner who discovers procedures usually understand it. Discovery and understanding supplement each other. Learners learn more rapidly and retain what he has learned for a long time when he discovers it by himself.

Concomitantly, this study is in conformity with the realms of the World Declaration on Higher Education for the Twenty-first Century (1998) in its call to a great diversification in Higher Education through innovative educational approaches: "the development of critical thinking and creativity in increasing classroom efficacy and the perceived need for a new vision and paradigm of higher education, which should be student-oriented. To achieve these goals, it may be necessary to recast curricula, using new and appropriate methods, so as to go beyond cognitive mastery of disciplines. New pedagogical and didactical approaches should be accessible and promoted in order to facilitate the acquisition of skills, competencies and abilities for communication, creative and critical analysis, independent thinking and team work in multicultural contexts, where creativity also involves combining traditional or local knowledge and know-how with advanced science and technology."

Appurtenant thereto, new methods of education will also imply new types of teaching-learning materials. These have to be coupled with new methods of testing that will promote not only powers of memory but also powers of comprehension, skills for practical work and creativity. (Cited by the World Conference on Higher Education at http://www.unesco.org/education/educprog/wche/declaration_eng.htm, 1998).

Objectives of the Study

The main purpose of this study is to determine the effects of personalizing the instruction on the academic achievement of the students in Physics.

Specifically, it presents the following:

1. What is the profile of the respondents in terms of:
    a. Gender;
    b. Age; and
    c. Mathematical Ability.
2. What is the level of achievement in Physics of the students in the experimental and control group?
3. Is there a significant effect of the personalized instruction on the students' academic achievement in the experimental and control group?
4. Is there a significant difference on the post-test mean score of the respondents across their mathematical ability?
5. What is the impact of the personalized instruction to the academic achievement of the students in Physics when grouped according to their Mathematical abilities?

Hypotheses

1. There is no significant effect of the personalized instruction to the academic achievement of the students in Physics when grouped according to their experimental grouping;
2. There is no significant difference on the post-test mean score of the students when grouped according to their ability;
3. There is no significant interaction between the method and ability of the students towards the subject.

Significance of the Study

Personalized instruction is imperative to enhancing the positive transfer of learning. In the learning of Physics, the students are supposed to be exposed in varied quantifiable experiments, problems and exercises in order to master the necessary skills. In order to achieve the mastery of these skills, formative intervention activities are to be executed in a constructive learning environment.

This study is mostly significant to the development of constructive approaches to assist students develop better academic achievement. It shall also provide bases for elaborating the communication approach responsive to the need for "more penetrating theories of mathematical thinking and learning in science" since the cognitively oriented science of thinking and the dynamic learning need to be harmonized with various theories of interactions and discourses of the teaching-learning process.

Research Paradigm

Different models of teachings have been flourishing as educationists are given the initiatives to design and/or redesign academic learning arrangements specifically geared towards providing the most supportive learning environment focused on student success. Bruner (1998) and Keefe (2000) argue that this kind of learning requires the active construction of knowledge through social interaction – a culture of reflection, collaboration and personalization.

Figure 1. presents the paradigm of this study.

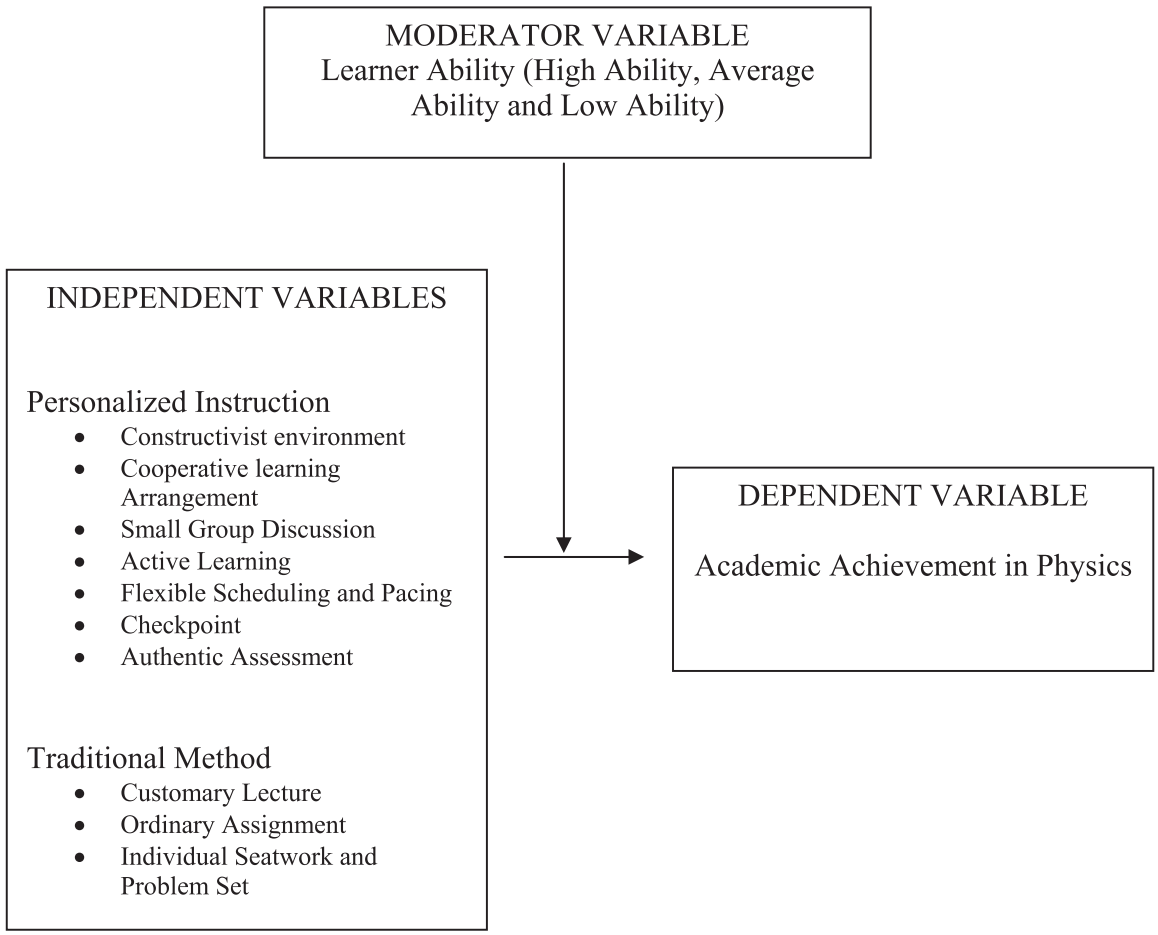

Figure 1. Research Paradigm.

The first input for this study is the determination of the learning history of the students in Mathematics as Physics is a potpourri of scientific concepts learned through mathematical analysis and interpretation. This is in response to the call that Teaching-Learning-Process must be responsive to the needs and nature of the leaner. The students were classified as high ability, average ability and low ability based on the average of their academic achievements in College Algebra and College Trigonometry as they are the prerequisites of the course. It made use of the following ranges: 1.75 – 1.00 – High Ability, 2.5 – 1.76 – Average Ability and 3.00 – 2.49 – Low ability.

It also redesigned the instructional initiatives of the teacher to actively engage learners in a series of meaningful learning arrangements that promote construction, collaboration, exploration, experimentation and reflection of what the learners are studying in a shared culture of cooperative learning. It started with a direct instruction and modeling from the teacher and group dynamics. Through small group discussion and peer mentoring, students were grouped into groups of at most five members. Oriented with their roles in the group, this creates a constructivist environment with positive interdependence through modeling with a helpful feedback before the learning tasks begins. This invited active learning and participation among the members of the group. Transcripts of their small group discussions and coaching were analyzed and verified through a direct observation by the teacher.

The introduction of flexible scheduling paved the realization of mastery as they went through their own pace of learning. The result of the analyzed transcripts determined the number of checkpoints made between the teacher and students. A module was introduced to the low ability learners to optimize their learning experiences. Their academic progress and academic achievement was monitored and determined through paper-pencil-test at the end of each checkpoint. If the student still lacks the mastery, another reconstruction was introduced and he shall start again in the process with another learning module.

Concomitant to the treatment conditions is an authentic assessment of learning geared to gauge their optimum learning in the subject. Rubric Assessment, as well as portfolio assessment, was also introduced.

Terms

Personalized Instruction, Academic Achievement, Constructive environment, Independent Learning, Cooperative Learning, Direct Instruction, Active Learning, Small Group Discussion, Academic Checkpoint, Authentic Assessment, Rubric Assessment, Portfolio Assessment

Methodology

Research Design

The Quasi-Experimental Design (pretest-posttest control group design) was used in this study. This provided bases for the causal effect of the independent variable to the dependent variable involving experimental and control groups. The impact of the personalized instruction to the academic achievement of the students in Physics was also elucidated when grouped according to their Mathematical abilities Lottery was used to determine the two-groups of the study.

Classroom session was diminished for the experimental group to pave way for their own pace. Buzz group, as well as cooperative learning, were made. Buzz sessions and check points were made once a week or as the need arise. A module was also introduced to respond to their own pace of learning.

On the other hand, the customary instruction was made to the control group with the usual class session, ordinary assignment and individual seatwork and problem set both in the theory and laboratory rooms.

Research Locale

This study was conducted at the General Education Department of Cagayan Valley Computer and Information Technology College, Inc., Santiago City, Isabela, Philippines, for the first semester, SY 2008–2009.

Respondents

The respondents of this study were the seventy eight (78) students enrolled in Physics 11, first semester, AY 2008, of the Cagayan Valley Computer and Information Technology College, Inc., Santiago City, Isabela, Philippines.

Data Gathering Procedure

The mode to which data were gathered for this study was the use of examination. Data were tabulated for analysis and interpretation. Analysis of transcripts, direct observation and rubric assessment in portfolio assessment were also employed aside from the customary paper-pencil test strategy of generating data.

Research Instrument

The instrument used in this study was a validated twenty (20) items teacher-made achievement test, developed by the researcher (Dissertation output: 2008), in Physics 11 covering topics in Mathematical Concepts, Mechanics and Heat as determined by a table of specification (TOS) based on the CMO 32 as the blueprint of the subject. The validation and refinement was conducted at the Secondary Teacher Education Program, Teacher Education Institute, Quirino State College, Diffun, Quirino, Philippines, where the author was previously employed as Instructor.

Items were analyzed using the chronbach's alpha. Reliability contained in the Achievement Test was determined with a coefficient reliability of 0.87. This means that the intercorrelations among the items in the test are of consistent and indicate that the degree to which the set of items measured a single unidimensional latent construct.

Statistical Tools Used

This study made use of frequency counts, mean, percentage and ANCOVA in treating the data gathered. It made use of SPSS in processing the data gathered for this study.

Result and Discussion

Table 1. Profile of the Respondents as to Gender.

	Experimental Group		Control Group		Total	
	Freq	%	Freq	%	Freq	%
Male	15	42.86	18	41.86	33	42.31
Female	20	57.14	25	58.14	45	57.69
Total	35	100	43	100	78	100

As shown in the table, there are seventy eight (78) respondents of the study where majority of them belong to the control group with 43 or 55.13 % while 35 or 44.87 % belong to the experimental group. It also shows that majority of the respondents are female with 45 or 57.69 % while 33 or 42.31 % are male. Therefore, majority of the BSIT students enrolled in Physics 11 for the first semester, AY 2008, are females.

Table 2. Profile of the Respondents as to Age.

Age	Frequency	Percent
20 and above	8	10.26
19	0	0
18	11	14.10
17	43	55.13
16	16	20.51
Total	78	100

As shown in table 2, the students are heterogeneous as to their age. Majority of them belong to the age of 17 with forty three (43) or 55.13 %; sixteen (16) or 20.51 % to the age of 16; eleven (11) or 14.10 % to the age of 18; and the least eight (8) or 10.26 % to the age of 20 and above. This implies that majority of the respondents are regular students.

Table 3. Profile of the Respondents as to Mathematical Ability.

Mathematical Ability	Experimental	Control	Total	Percentage
High ability	10	12	22	28.21
Average Ability	8	14	22	28.21
Low Ability	17	17	34	43.58
Total	35	43	78	100

Range: High – 1.75 – 1.00; Average – 2.50 – 1.76; Low 3.00 – 2.49

Table 3 presents the profile of the respondents as to their mathematical abilities based on their average in College Algebra and College Trigonometry. It presents that majority of the respondents are having a low mathematical ability with 34 or 43.58 % of the entire respondents, while both high and average mental abilities have 22 or 28.21 % of the respondents. It could be said that the groups of respondents are heterogeneous. It could also be inferred that the groups need an constructive learning environment for them to be assisted in their learning tasks and experiences in the subject.

Table 4. Mean Scores of the Respondents in the Post-test.

	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control Group	11.537[a]	.302	10.934	12.140
Experimental Group	13.761[a]	.311	13.142	14.380

a. Covariates appearing in the model are evaluated at the following values: Pretest = 11.04.

As presented in the foregoing table, it shows that the mean score of the control group is 11.537 while the experimental group earned a mean score of 13.761. These results were evaluated with the covariate value of the pre-test conducted, 11.04. This means that the students in the experimental group performed better than their counterparts in the control group.

Table 5. Tests of Between-Subjects Effects on Academic Performance.

Source	Type III Sum of Squares	Df	Mean Square	F	p-value
Corrected Model	644.200	6	107.367	35.155	.000
Intercept	23.437	1	23.437	7.674	.007
Pre-test	139.585	1	139.585	45.705	.000
Method	**79.137**	**1**	**79.137**	**25.912**	**.000**
Ability	2.515	2	1.258	.412	.664
Method * Ability	**19.570**	**2**	**9.785**	**3.204**	**.047**
Error	216.838	71	3.054		
Total	13199.000	78			
Corrected Total	861.038	77			

a. R Squared = .748 (Adjusted R Squared = .727)

Presented in table 5 is the two-way analysis of covariance of the tests conducted between the two groups of the study. It shows that the mean composite score obtained by the students in the experimental group is highly significantly higher than the mean composite score of the control group (F-value = 25.912

and p-value < 0.001). This means that the students under the experimental group who experienced the personalized instruction performed better in the subject after the method was introduced in their learning experiences and became a potent mechanism in their learning-routine.

The null hypothesis of no significant difference between the mean academic achievement of students exposed to the personalized instruction and the traditional model of teaching is, therefore, rejected. This means that personalizing the instruction is significantly better than the traditional model in terms of impact on the overall academic achievement of the students.

It may be noted, however, that the impact of the models of personalizing the instruction is moderately high considering that the coefficient of determination indicated by the adjusted R-squared is only 72.7 % which means that the models of teaching account for only 72.7 % of the variability in the academic achievement of the students. It is construed then that there are other important variables or factors such as student ability and other classroom techniques which may explain better the difference in the academic achievement of the groups of students in both the experimental and control groups.

Table 5 likewise presents the interaction between the mathematical abilities of the students and the method (treatment conditions of personalized instruction). It presents the impact of of the treatment conditions to the academic achievement of the students across the mathematical abilities of the students in the two groups as shown in Figure 2.

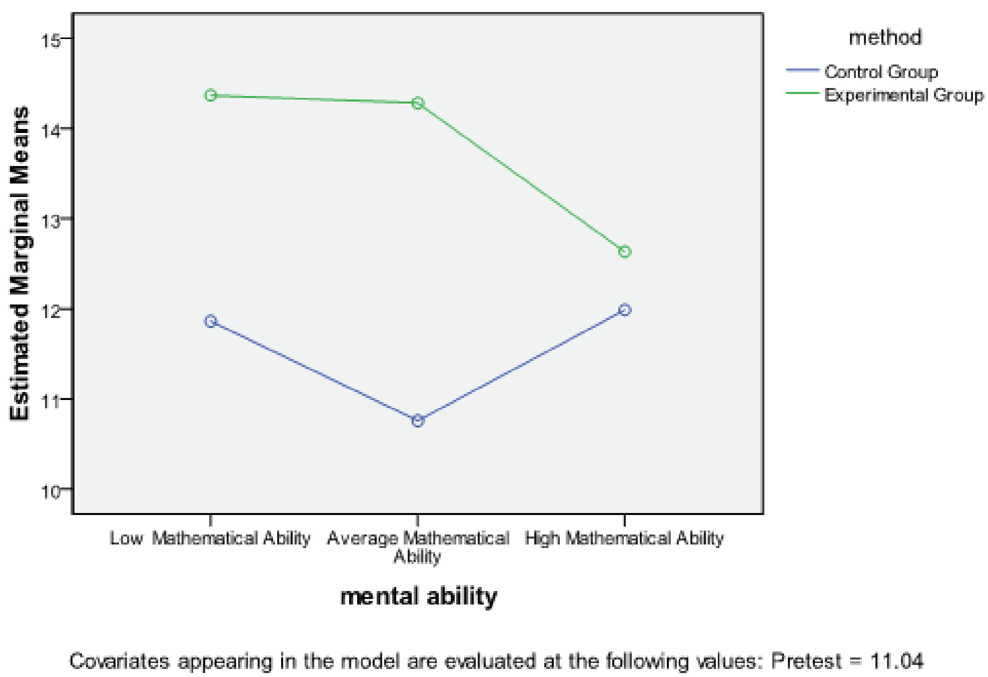

Figure 2. Estimated Marginal Means of the Post-test.

Figure 2 presents the relationship of the estimated marginal means of the post-test result and the mathematical abilities of the students, categorized as low, average and high. The result of the post-test mean score is evaluated with the pre-test covariate value of 11.04. It presents that that students who are averagely able in Mathematics benefited the most in the program followed by the lowly mathematically able students. Surprisingly, there is no significant pattern to be discriminated on the scores of the highly able students in Mathematics.

It could also construed then that there are other important variables or factors such as other student ability, other classroom techniques, among other variables, which may explain better the difference in the academic achievement of the groups of students in both the experimental and control groups.

The results of the study indicate that students who were exposed to the personalized instruction obtained a significantly higher mean post-test score on their academic achievement than the students who were exposed to the customary teaching models and techniques. This result supports the findings obtained by Gokhale (1995), Mevarech (1999) and Schafersman (1991) who reported that the students in the collaborative learning group posted better scores on the critical thinking test than students who studied individually.

Various proponents of personalized instruction, collaborative instruction and constructivism claim that the active exchange of ideas within small groups not only increases interest among the members of the group but also promotes critical thinking and academic achievement. As cited by Johnson and Johnson (1986) in Petilos (2003) there is convincing evidence that cooperative teams achieve higher levels of thought and retain information longer than students who work only as individuals. The shared learning during small-group discussion gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers (Totten, Sills, Digby, & Russ, 1991 as cited by Gokhale, 1995). Small-group discussion also engenders further thinking since students are engaged in activity, reflection, and conversation where the learners become responsible for defending, proving, justifying, and communicating their ideas to the other members of the group (Fosnot, 1996).

Pursuing the intended scientific disposition requires the initiation and mediation of personalized instruction in a reconstructed environment of acquisition processes among students. Passive learners deserve special attention in this respect because they should be helped to develop more active learning strategies. To this end, an approach that can truly be effective in terms of developing critical thinking skills and academic achievement of the students is to employ strategies of teaching that are compatible with an active-constructive learning environment. There is therefore a need for all Higher Education Institutions (HEIs) to expose the students with various approaches in teaching concepts and principles in Physics. This is urgent since one of the philosophies of the World Declaration on Higher Education states that "the ideal teacher is not authoritarian but the trustworthy facilitator of the learning processes, who enables the learners to become active constructors of meaning and not passive recipients of information." Thus, insofar as the objective of raising the quality of physics achievement among students is concerned, the radical change of personalizing the instruction of teaching Physics is therefore at the helm of all the Higher Education Institutions.

Conclusion and Recommendation

Summary and Conclusion

1. Majority of respondents are female, 45 or 57.69%;
2. Majority of the respondents are regular students as they belong to the age of 17 with 43 or 55.13 %;
3. Majority of the respondents belong to the low mathematical ability with 34 or 43.58 %;
4. The students in the experimental group performed better than their counterparts in the control group as evidenced by their post-test mean score, 13.761 vs 11.537;
5. There is a highly significant effect of the personalized instruction to the academic achievement of the students in Physics, p-value < 0.001. Therefore, hypothesis 1 is rejected. This means that personalized instruction is an effective mechanism of increasing classroom efficiency. Passive learners deserve special attention in this respect because they should be helped to develop more active learning strategies;
6. There is no significant difference on the post-test mean scores of the respondents across their ability, p-value $= 0.664$. Therefore, hypothesis 2 is accepted;
7. There is a significant interaction between the method and mathematical ability of the students towards developing a better academic achievement, p-value $= 0.047$. Therefore, hypothesis 3 is rejected. This means that personalized instruction is a potent tool in reconstructing the academic learning environment across students' learning abilities.

Recommendations

1. The elaboration of the mathematical coping skills must be intensified since majority of the respondents belong to the low mathematical ability group. A revisit on the learning outcomes and learning competencies in College Algebra and College Trigonometry must be strengthened since they are potent central learning schema in discriminating concepts and principles in Physics. Apropos of, the success in working out Physics related problems depends largely on one's ability to use mathematical models.
2. The conglomeration of cognition and communication must also be evaluated since taking scientific-mathematical discourses involve communicational approach to cognition and dialogical approach to discourse, cognition and communication. There should be a concerted effort to develop the facility of the students in the use of the English language since this is the tool for learning Physics and Mathematics.
3. Exhaust factors of developing esteem among students as the exposure to personalized instruction in a reconstructed environment enables learners to become active constructors of meaning and not passive recipients of information.
4. Design a more challenging program of learning experiences that would respond best to the needs of the higher ability group.

References

Books

1. Burnham, John West and Max Coates (2005) Personalizing Learning: Transforming Education for Every Child. Network Educational Press Ltd.
2. Clarke, Shirley (2008). Active Learning through Formative Assessment. Hodder Education.
3. De Freitas, Sara and Chris Yapp (2005). Personalizing Learning in the 21st Century. Network Continuum Education.
4. Hammond, Linda Darling (1993) "Reframing the School Agenda: Developing Capacity for School Transformation," Phi Delta Kappa Education.
5. Herbert J. Walberg and John J. Lane, eds. (1989). Organizing for Learning: Toward the 21st Century (Reston, Va.: National Association of Secondary School Principals.
6. Jenkins, John M and James W. Keefe (2008). Personalized Instruction: The Key to Student Acheivement. 2nd Edition. Rowman & Littlefield Education.
7. Jenkins, John M and James W. Keefe (2002). Two Schools: Two Approaches to Personalized Learning. Thomas Haney Secondary Centre.
8. Jenkins, John M and James W. Keefe (2005). Personalized Instruction. Phi Delta Kappa Educational Foundation.
9. Keller, Fred Simmons and John Gilmour Sherman. (1974). PSI, The Keller Plan Handbook: Essays on a Personalized System of Instruction.
10. Nordlund, Marcie (2003). Differentiated Instruction: Meeting the Educational Needs of All Students in your Classroom. Scarecrow Press.
11. Pollard, Andrew (2008) Reflective Teaching: Evidence-informed professional Practice. Continuum International Publishing Group Ltd.
12. Smutny, Joan F. Differentiated Instruction (2003). Phi Delta Kappa Educational Foundation.

Journals

13. *Journal of Personalized Instruction* (1978) Center for Personalized Instruction. Georgetown University.
14. Sanqui, Sofronio(1992). "Modular Instruction: Aid for an efficient and effective Teaching-Learning Process". *The Filipino Teacher*. Vol. **15**.

15. Eniaiyeju, Paul A. (1998) "The Comparative Effects of Teacher-Demonstration and Self-Paced Instruction on Concept Acquisition and Problem – Solving Skills of College Level Chemistry". *Journal of Research in Science.*

16. Ovando, Martha S. (1991) Competency-Based Individualized Learning Modules: Resource in Education.

17. Zaffaroni, Joseph and Salberg, Edith. (1991) New Development in Science Education. National Science Teachers Association,

Unpublished Materials

18. Bautista, Romiro G. (2005) "The Efficacy of a Module in Teaching General Chemistry".

19. Bautista, Romiro G. (2005) "A Workbook in Teaching Physics 11 (Mechanics and Heat)."

20. Jasmin, Analiza C. (2005) "The Effect of Personalized System of Instruction (PSI) on the Achievement of Students in College Algebra at Quirino State College."

21. Ku, Heng-Yu and Howard J. Sulivan (2002) Student Performance and Attitudes Using Personalized Mathematics Instruction.

22. Ku, H.-Y., & Sullivan, H.J. (2000). Personalization of Mathematics Word Problems in Taiwan. *Educational Technology Research and Development.*

23. Lopez, C.L., & Sullivan, H.J. (1992). Effect of Personalization of Instructional Context on the Achievement and Attitudes of Hispanic Students. *Educational Technology Research and Development.*

24. Pagulayan Alfonso G. (1989) "Analysis of the Students Perception on the Objective Instructional Methodology and Materials, Evaluative Measures and Problems in General Zoology: Implication to Teaching."

25. Petilos, Gabino P. (2003) "Constructivist Model in Teaching Problem Solving."

26. Samson Ma. Salome. (1987) "A Comparative Effectiveness of the Modular and Traditional Approach in Teaching Selected Lessons in English to Sixth Graders of San Roque Elementary School, Marikina District, Division of Quezon City.