Widodo, A. (2008). Science Education Research in Indonesia: The Case of UPI. Proceeding of the Second International Seminar on Science Education. Bandung 18 October 2008.

SCIENCE EDUCATION RESEARCH IN INDONESIA: THE CASE OF UPI

Ari Widodo
(Postgraduate School of Science Education Indonesia University of Education)

Abstract
This paper presents analyzes of research conducted by prost graduate students as part of their study at the Postgraduate School of Science Education, Indonesia University of Education. Data are based on 364 masters and doctoral thesis of the alumnae starting from 1979 to 2008. Through this study a portrait of the topics of the research, methodology used, and subjects participated are identified. This should provide information of what area that have been sufficiently explored and what are still need further studies.

Introduction
The postgraduate school of science education, Indonesia University of Education (previously UPI) has been serving for three decades. A number of research projects have been done by the students as part of the completion of their studies. It is difficult to have a picture of the nature of research projects that have been done since there is no meta-analyses have been done. It is the aim of this paper to provide a brief picture of the kinds of research projects.

Research in science education shows continuous changes. Some of the important changes are research method employed and the topics addressed in the study (White, 1997). In terms of methodology, research tends to move from experimental toward descriptive studies that are based on interviews, observation rather than test. White (1997) also noted that a number of topics disappear and new topics emerge or re-emerge.

A review of science education research in Europe (Jenkin, 2001) reveals that issues related to teachers, students, textbook, pedagogy, curriculum and assessment were very common. Many of the studies are conducted in formal school, especially secondary school. Based on his review he proposes a number of issues for the next research, such as research on policy and practice, research on teaching rather than learning, research that less directly concerned with practice but sharpening thinking, clarifying issues, and encouraging debate. These areas of research are not yet sufficiently explored but may contribute to the improvement of science education.

In his brief summary of major focuses of science education research, Duit (2007) mentioned that teaching and learning has drawn the attention of most researchers since a long time. In the 1980s students learning was the central focus, especially students learning of particular concepts or principles. It was then followed by research on constructivism and conceptual change that are very often done in the 1990s. Another topic becoming more significant area of research is issues related to the nature of science. Duit (2007) found that science education research are mostly done in simplicity ways. He suggests that in the future science education research should move toward more interdisciplinary, should not be restricted to investigation of what works but also problems and deficits of normal instruction practice, and should link science subject matter as well as pedagogical and psychological issues.

Method

A total of 364 master and doctoral thesis was analyzed in this study. Though this paper does not cover all theses, however, it managed to analyze around 90 percent of the total thesis. A number of thesis cannot be included in the analyses due to the difficulty to access the documents. For the purpose of the study thesis are analyzed in terms of the subject participated in the study, the method of the study, and the educational issues addressed in the study.

Results

1. Distribution by year

The number of master and PhD thesis published each year is presented in Table 1. During the last decades the number of graduates significantly increases compare to the last two decades. In 2000 alone there were 106 graduates. The increase of the students may reflects the awareness of teachers and lecturers to improve their competencies.

Table 1 Thesis published each year

No	Year	Types of publication		Total
		Master thesis	PhD thesis	
1	1979	-	1	1
2	1982	-	2	2
3	1985	-	1	1
4	1986	-	1	1
5	1987	2	-	2
6	1988	1	-	1
7	1990	-	2	2
8	1991	1	-	2
9	1992	-	1	2
10	1993	3	-	3
11	1994	4	-	4
12	1995	5	-	5
13	1996	9	2	11
14	1997	26	4	30
15	1998	5	1	6
16	1999	12	-	12
17	2000	106	-	106
18	2001	17	4	21
19	2002	23	2	25
20	2003	6	3	9
21	2004	12	3	15
22	2005	36	5	41
23	2006	11	1	12
24	2007	31	2	33
25	2008	17	-	17
Total		327	37	364

The number of PhD thesis is relatively stabile each year, though there is a tendency to increase in the last 7 years.

2. Participants

Senior High School is very often chosen as a target of the studies (Table 2). Limited research is done to Primary and Junior High School. Studies done to primary school are mainly conducted between 1996 - 1999. Outside this time relatively no studies are conducted to primary school.

Table 2 Participants of the study

No	Participants	Total
1	Primary school	60
2	Junior high school	51
3	Senior high school	199
4	University	43
6	Teacher	10
5	General	2

3. Subjects

Biology and physics are clearly two subjects frequently explored, while general science and chemistry relatively seldom explored (Table 3). The situation is mainly due to the educational background of the researchers. General school science is relatively seldom addressed since most researchers tend to take biology, chemistry or physics. As a results information on the teaching of integrated school science is very rare.

Table 3 Subjects matter studied in the thesis

No	Subjects	Total
1	Biology	116
2	Chemistry	61
3	Physics	130
4	Science	55
5	Health	1
Total		363

4. Method of study

Experimental is clearly the most popular method employed by the researchers (Table 4). Experimental studies are found in almost every year. Descriptive studies are also quite often done, although it is not as frequent as experimental studies. The number of classroom action research is also relatively high. This method appears mainly between 1997 and 2000. Since 2002 Research and Development (R & D) emerge as a new research methods employed by the researchers.

Table 4 Method of study

No	Method	Total
1	Experiment	153
2	Descriptive	107
3	Classroom Action research	71
4	Research & Development	4
5	Correlational	5

5. Educational themes

Since most of the studies include two variables, results related to educational themes are presented as first variables and second variables.

a. First educational theme

Teaching models, teaching approaches, and teaching media are three most popular themes (Table 5). Almost 60% of research studies are about these three themes. Indeed, there are a number of educational themes appeared in the publication, however, they do not show a strong influence on the whole themes.

Table 5 The first educational themes of the study

No	Themes	Total
1	Teaching model	124
2	Teaching approach	47
3	Teaching media	36
4	Assessment	21
5	Thinking/reasoning skills	18
6	Subject matter analyzes	16
7	Teaching method	14
8	Practical work	12
9	Concept understanding	11
10	Teachers competencies	10
11	Classroom analyses	9
12	Conception/misconception	9
13	Questioning skills	7
14	Learning difficulties	6
15	Concept application	5
16	Classroom organization	5
17	Textbook	4
18	Supervision	2
19	Inquiry	2
20	Extracurricular	1
21	Homework	1
22	Etno science	1
23	Curriculum development	1
24	Training	1
25	Policy analyses	1

26	Nonintelectual characteristics	1
27	Science process skills	1
28	Learning organization	1
29	Didactic reduction	1
30	Attitude	1
31	Remedial teaching	1
32	Vocational skills	1
33	Publication writing	1

b. Second educational themes

The second variable is a variable that mainly interpreted as a product of the first variable. In most cases, the second variable is defined as students' achievement as a result of the employment of the first variable. In most cases studies students' achievement is limited to concept understanding, thinking skills, science process skills, attitude, and problem solving skills (Table 6).

Table 6 The second educational themes of the study

No	Theme	Total
1	Concept Understanding	141
2	Thinking skills	31
3	Science process skills	25
4	Attitude	14
5	Problem solving	10
6	Generic skills	5
7	Inquiry	5
8	Interest	4
9	Teachers competencies	4
10	Scientific literacy	3
11	Habits Of Mind	3
12	Syllabi	3
13	Learning activity	2
14	Misconception	1
15	Leaning styles	1
16	Cognitive structure	1
17	Students readiness	1
18	Empirical inductive	1
19	Perception	1

6. Development of the research

Analyses of the changes of the publications show clear changes in the number of the publication, the participants, and the subject. However, there is no significant change in terms of methodology and educational issues (Table 7). The number of the publication clearly relate to the interest of the educators and practitioners to improve their competencies.

Table 7 Development of the research

No	Period	Number of publication	Participants	Subject	Method	First variable	Second variable
1	1979-1989	8	Senior high school (50%)	Biology (50%)	Descriptive (63%)	-	Student understanding (63%)
2	1990-1999	76	Primary school (34%)	Science (33%)	Descriptive (33%) Experiment (33%)	Teaching models (27%) Teaching approach (11%)	Student understanding (49%)
3	2000-2009	280	Senior high school (61%)	Physics (37%) Biology (36%)	Experiment (44%)	Teaching models (33%) Teaching approach (13%)	Student understanding (37%)

Discussion

It is not the purpose of this article to compare research studies we have done in Indonesia and what others have done in other part of the word since the situations, the needs, and the issues that we have may be very different. However, analyzing of what we have done and comparing it with what others have done should help us in reflecting and finding insight in improving our research.

The characteristics of research studies done by postgraduate students are in many respects similar to research studies done by undergraduate students (Widodo, 1997). Such similarities are found in:

- Methodology: experiment
- Educational themes: teaching methods, models, approaches, and students' achievement
- Participants: Senior High School

Such similarities strongly suggest that data obtained in this study is relatively valid. In terms of the methodology, our research is similar to the research studies done in the early 1980s (White, 1997). At that time research are mostly done in experimental designs. Meanwhile, a similarity with European research is found in terms of the research participants, i.e. senior high school students (Jenkin, 2001).

A more critical differences, perhaps, is the educational themes. Most of our research studies are done in simplicity ways, for example the influence of X to students' achievement. Improvement of students' achievement is not to be expected from a change in one single variable. As Duit (2007: 13) says: "Such simple actions usually do not work". He proposes that science education research should address issues in a more comprehensive ways since science education is a multiple-disciplinary discipline.

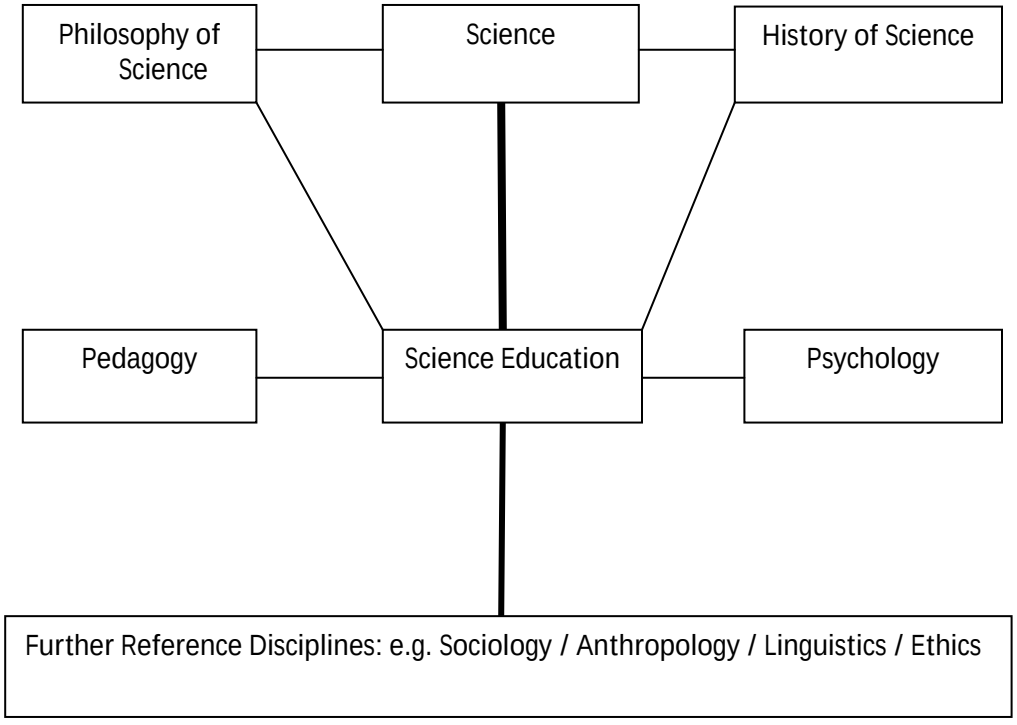

Figure 1 Reference disciplines for science education (Duit, 2007)

At the current situation it seems that our research studies focus largely on pedagogy and science, while other disciplines are not yet explored. Unfortunately, the pedagogical issues explored are limited certain issues, such as teaching methods, models, and approaches. In terms of science, most research treated science as a by product of the changes in pedagogical aspects. The nature of scientific concepts is rarely studied. A number of educators (Baumgartner, et al., 2002; Duit, 2007; Jenkin, 2001) clearly suggest that successful design of science teaching and learning should merge content and pedagogical aspects.

This study finds that research conducted by masters and PhD students at the Postgraduate School of Science Education, Indonesia University of Education shows a number of changes. These studies, however, tend to focus on a certain aspects and using a certain methodology. In the future research studies need to address multidisciplinary issues, employ a more comprehensive methodology, and do in a more balanced educational level.

References

Baumgartner, et al. (2002). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher, 32*(1), 5-8.

Duit, R. (2007). Science education research internationally: Conception, research methods, domain of research. *Eurasia Journal of Mathematics, Science & Technology Education, 3*(1), 3-15.

Jenkin, E. W., (2001). Research in science education in Europe: Retrospect and prospect. In H. Behrendt, H. Dahncke, R. Duit, W. Graeber, M. Komorek, A. Kross & P. Reiska, Eds., *Research in Science Education – Past, Present, and Future*. Dordrecht: Kluwer Academic Publishers.

White, R. (1997). Trends in research in science education. *Research in Science Education, 27*(2), 215-221.

Widodo, A. (1997). *Arah dan kecenderungan skripsi/tugas akhir mahasiswa Jurusan Pendidikan Biologi*. FPMIPA IKIP Bandung.