Research Artikel

TREND IN BIOLOGY EDUCATION RESEARCH FROM 2012 TO 2017: A CONTENT ANALYSIS OF PAPERS IN SELECTED JOURNALS FROM INDONESIA

TREN PENELITIAN PENDIDIKAN BIOLOGI 2012-2017: ANALISIS KONTEN PAPER DI JURNAL TERSELEKSI DARI INDEKS PUBLIKASI INDONESIA

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Abstrak

Artikel ini telah menjelaskan kajian tentang tren penelitian di bidang penelitian pendidikan biologi di Indonesia sepanjang tahun 2012-2017. Studi ini telah menganalisis artikel-artikel yang telah dipublikasikan di jurnal ilmiah yang telah diindeks di Indonesia Publication Index. Pada bagian pendahuluan penelitian, kami telah menemukan hanya empat jurnal yang memiliki skop secara spesifik di bidang pembelajaran biologi. Keempat jurnal tersebut adalah Journal of Biology Education, Bioedu, Bioedukasi dan Didaktika Biologi. Dalam keempat jurnal ini kami juga telah menemukan 547 artikel yang telah dipublikasikan sejak tahun 2012-2017. Semua artikel ini telah diunduh dan dilakukan analisis konten. Analisis konten dilakukan mengacu kepada tujuh aspek yaitu topik biologi, subjek penelitian, metode/desain penelitian, elemen penelitian, alat pengumpul data, jenis dan ukuran sampel dan teknik analisis data. Data yang telah diperoleh, telah dianalisis dengan statistik deskriptif dan telah ditampilkan dalam bentuk tabel dan grafik. Kesimpulan penelitian ini adalah tren penelitian di bidang penelitian pendidikan biologi di Indonesia sepanjang tahun 2012-2017 dibedakan menjadi tujuh kategori yaitu topik biologi adalah bentuk dan fungsi hewan, subjek penelitian adalah pengajaran dan pembelajaran, metode/desain penelitian adalah eksperimen, elemen penelitian adalah kognitif, alat pengumpul data adalah tes prestasi belajar, jenis sampel adalah siswa-siswa sekolah menengah atas dan ukuran sampel adalah 31-100 dan teknik analisis data adalah teknik kuantitatif..

Kata Kunci: *penelitian pendidikan biologi; analisis konten; indeks publikasi Indonesia*

Abstract

This article was to describe research trends in Biology Education Research (BER) in Indonesia across year 2012-2017. This study was conducted by descriptive quantitative, with a content analysis the article that has been published in scientific journals that indexed in the Indonesia publication index. The content analysis were refer to sevent subjects were biology topics, teaching and learning, research design/methods, research element, data collection tools, samples and sample sizes and technique of the data analysis. The data obtained were analyzed with descriptive statistics and displayed in tables and graphs. We founded that only four journals have been scope specifically in the biology learning. The four journals were Journal of Biology Education, Bioedu, Bioedukasi and Didaktika Biologi. In theses journals, we also found 547 articles published from 2012-2017. All of these articles were downloaded and all of theses articles were subjected to content analysis. The result of the study showed that research trends BER in Indonesia across the year 2012-2017 were devide on seven categorizes such as; biology topics was animal form and function, teaching and learning was subject matter, research design/methods was quantitative experimental design, research element was cognitive, data collection tools was achievement test, samples was the students at Senior High School (SMA) and the size of samples was between 31-100 and technique of the data analysis was quantitative method. The implication of this study has implicated that to be an information for the researcher being conduct their researchs. The result of this study also will be contributed for the teachers and educator in teaching and learning of research of methodology in biology education.

Keywords: biology education research; content analysis; Indonesia publication index

INTRODUCTION

A content analysis process (Elo & Kyngas, 2008) in selected papers or thesis will helped the researchers to explore the current status of the researches and trends in the biology education research (BER) (Gul & Sozbilir, 2015). For example, the current status about the environment, cell, the variety of the living beings, tissues, evolution, systems and energy were the content were found in the student of thesis in Turkey (Derman, 2017). The content about environment, ecology, genetics, biotechnology, animal form and function were biology topics that investigated in selected papers (Gul & Sozbilir, 2015). In other articles, the other contents were also investigated by other researchers, such as the investigation about the change of conceptual and concept mapping (Chang *et al.,* 2010), inquiry-based learning, argumentation, scientific modeling and the students of the concept of learning by science education scholars (Lin *et al.,* 2014).

The investigation about the content analysis of papers in journals or thesis were not a main research in Biology Education. Because grand challenges in biology education research was focused on biology instruction (McComas *et al*., 2018) to improved the quality of the learning process and students achievement. There were studies has been conducted by previous researchers, such as metaphorical perceptions of the concepts teaching profession and raising students (Bezen *et al.*, 2017) and the investigation of the nature of metaconceptual processes of pre-service biology teachers (Yuruk *et al.*, 2017). In Indonesia, there were studies has been conducted by previous researchers that to improved the quality of the learning process and student's achievement. For example, the using of discovering learning strategy to increase metacognitive knowledge on biology learning (Herlanti *et al.,* 2017); analysis of knowledge and cognitive domain on indonesia secondary school curriculum (Herlanti, 2016); metacognitive attitude and ability of students and teachers on science program class (Herlanti & Soekisno, 2018) and the effect of argument mapping method and self efficacy on critical thinking ability (Agnah *et al.,* 2018). The others

research were the using of thinking map on human anatomy (Haviz *et al.,* 2018), the using of research based learning model on research method of biology (Haviz, 2018), the using of computer-assisted biology learning materials on spermatogenesis (Haviz, 2018) and the using of integrated learning on developmental of biology (Haviz *et al.*, 2012; Haviz, 2013; Haviz, 2016), the using of modern instructional design on biology learning (Haviz, 2015) and the using of cooperative learning on developmental of biology (Haviz, 2015). But, we assume that the investigation about the current status of the research on biology education were also important for the researchers in biology education research. Because there were more information about biology education research that needed by the researchers.

The Indonesia Publication Index was a portal built by the the Ministry of Research Technology and Higher Education. This portal was built to publishe the result of the research in Indonesia (Dirjen Dikti, 2012). The Indonesia Publication Index found on the page http://id.portalgaruda.org/. Starting on July 4, 2018 the Indonesian Publication Index (IPI) has been acquired by the Ministry of Research Technology and Higher Education, its called Garuda (http://garuda.ristekdikti.go.id). We found 31 journals that have studies in the field of mathematics and science education, and only 4 journals that specifically only publish articles in the field of biology education and learning. The four journals were Journal of Biology Education (JBE), Bioedu, Bioedukasi and Didaktika Biologi (DB). Based on preliminary findings, we also have not found an analysis report on content about biological research in journals published in IPI.

Research design/methods were used to study and solve the problems in the field of education and learning were quantitative, qualitative, mixed methods and action research (Creswell, 2014), and research and development or/and educational design research (Haviz, 2013; Plomp, 2010). The quantitative research designs concisted descriptive, correlation, survey, causal comparative, experiment and single subject, and the qualitative research design were narrative and ethnography (Creswell, 2014). Allegedly, the authors who published the

results of the research in scientific journals in Indonesia were also used the one of theses methods/designs in their studies.

Biology learning materials were taught by students in Indonesian schools were very complex and diverse. These conditions also caused complex and variety in content that used by the researchers in the field of biology education and learning. The results of the preliminary study showed that there were 8 material published in biology learning in Indonesian schools. These materials were Material 1. Biology as part of science, includes knowledge of scientific and biological properties, general description of living things, material and compounds of living creatures and organizations of life. Material 2. Cells, including transportation of matter, diversity and classification of living things, kingdoms and images, division of cells and cells. Material 3. Genetics and heredity, includes reproduction, growth and development, modern genetics and biotechnology, from genes to proteins and the basic principles of heredity. Material 4. Environmental research, including current environmental conditions, ecosystems, biomass, ecological communication and ecological populations. Material 5. Evolution, includes behavior, the origin of life and evolution. Material 6. Plants and their functions, including plant structures and tissues, hormones and homeostasis, transport of substances in plants and kingdom plantae. Material 7. Animals and their functions, including animal tissues, nervous system, digestive system, respiratory system, urinary system / excretion, circulatory system, muscular system, skeletal system, immune system, esndocrine system, sensory system, invertebrate animals and animal vertebrates. Material 8. Energy, includes energy and vitality, photosynthesis, cellular respiration and chemosynthesis (Kimball, 2006).

This study was to examine research trends in the field of education and learning biology in Indonesia. The article reviewed was an article that has been published in a scientific journal indexed in the Indonesia Publication Index (IPI). Similarity with this study, we found that there are six aspects such as topics or biological material, research subjects, research methods, data collection tools,

research samples, and data analysis on BER in Turkey (Gul & Sozbilir, 2015). In this study, we have adds one aspect were topics, research subjects, research elements, research methods, data collection tools, research samples, and data analysis. The purpose of this study was to described that the research trends in biology education research (BER) was published in Indonesian scientific journals across year 2012-2017. In line with this aim to further examine the purpose of the research, we divided into seven sub-questions;

1. What is the frequency of BER topics?
2. What is the frequency of BER subjects matter?
3. What is the frequency of BER research design/methods?
4. What is the frequency of BER research elements?
5. What is the frequency of BER data collection tools?
6. What is the frequency of BER sample and sample size?
7. What is the frequency of BER data analysis methods?

METHOD

This study was conducted by descriptive quantitative, with a content analysis the article that has been published in scientific journals that indexed in the Indonesia Publication Index. We used a content analysis to conduct this research, and data analysis used descriptive statistic (Creswell, 2014). Data collection tool was Paper Classification Form (PCF). This instrument was developed by Sozbilir *et al* (2012) and it's was reported have been revised, and reusing by Reece *et al* (2013), and it's was adding biological material as the subject being studied. Then, Gul & Sozbilir (2015) was use PCF to conduct a content analysis of papers in selected journals. In this study, PCF contains 7 aspects of BER; topics, subjects matter, research design/methods, research elements, data collection tools, sample and sample size and data analysis methods.

The articles were collected from the Indonesia Publication Index (IPI) that founded on

the page http://id.portalgaruda.org/Indonesia publication index (IPI). We found only four journals have scope in biology learning. The four journals were Journal of Biology Education, Bioedu, Bioedukasi and Didaktika Biologi. All of these articles were downloaded and subjected to content analysis. The data obtained were analyzed with descriptive statistics and displayed in tables and graphs.

RESULT AND DISCUSSION

The results showed that Journal Biology of Education published 227 articles or 41.49%, Bioedu published 184 articles or 33.63%, Bioedukasi published 129 article or 23.58% and Didaktika Biologi published 7 articles or 1.27%. Finally, the total articles found in these four journals across year 2012-2017 were 547 articles.

Frequently Investigated Biology Topics

The result about the investigation of BER topics showed that animals and their functions were 34.00%. These findings were the most widely used topics that be chosen by the researchers. The investigation of the mechanism of evolution showed that the smallest topics chosen by the researchers, as a score 1.20%. The results of content analysis on biology topics have been summarized in Table 1.

Tabel 1. Frequently investigated biology topics by the researchers of BER in Indonesia across year 2012-2017

Biology Topics	f	%
Animal form and function	164	34.00
Environment and ecology	119	25.00
Plant form and function	59	12.00
Genetics and biotechnology	26	5.40
The cell	21	4.40
General biology	21	4.40
Biodiversity	19	3.90
The chemistry of life	16	3.30
Mechanisms of evolution	6	1.20
Others	31	6.40
Total	482	100.00

*Some of researchers was not chose biology topics as a topic in their research

Another finding in this section showed that there were the researchers or writers did not chose biology as the object of research material. For examples, the teacher's competencies, the curriculum of 2013 (K-13), peer tutors, textbooks, laboratories, student perceptions. The complete results of this finding were summarized in Figure 1.
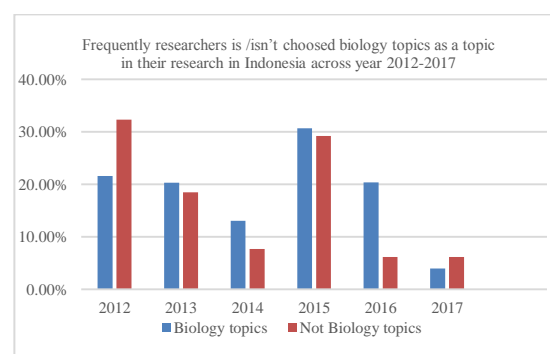

Figure 1. Frequently researchers was /was not chose biology topics as a topic in their research in Indonesia across year 2012-2017

This finding showed that animal material and its function were the most topic that chosen by researchers. This finding indicated that animal material and its function were difficult material for students. Because animal characteristics and functions in biological learning contain facts, concepts, theories and processes (Haviz, 2016; Haviz, 2018; Haviz et al., 2018). The finding similiarity with others studies, such as researchs were conducted by Fonseca et al (2012), Reis & Tunnicliffe (2001), Çimer (2012) and Usak et al (2009). These studies showed that the students, prospective teachers and teachers still had limited knowledge, difficulties in learning, failed to understand material and other negative attitudes to the topic of animals and their functions. Especially in sub topics nutrition, circulation and gas exchange, immune system, osmoregulation and excretion, hormones and the endocrine system, reproductive system, nervous system, sensory and motoric mechanisms, and environment and ecology.

Frequently Investigated Subject Matter

The result about the investigation of BER subjects matter in Indonesia across year 2012-2017 showed that the material about teaching was the highest subject and the most widely used in the study, which amounted to 35.00%. Whereas the least used material were other material or material that were not included in the 12 categories specified in the PCF, its score were 0.20%. The complete data were summarized in Table 2.

Table 2. Frequently investigated subject matter of BER in Indonesia across year 2012-2017

Subject Matters	f	%
Teaching and learning	209	35.00
Source of learning	176	29.00
Nature of science	48	7.90
Computer aided instruction	44	7.30
Test	44	7.30
Knowledge	22	3.60
Curricullum studies	15	2.50
Analysis Concept analysis	15	2.50
Teacher training	11	1.80
Research methods studies	10	1.70
General educations problems	6	1.00
Attitude/perception	3	0.50
Others subjects	1	0.20
Total*	604	100

*Some researchers were chosen more than one subject matter in BER Indonesia

The other findings in this section were found that the researchers who publish the results of the study used several research subjects or chose more than one subject when conducting research. The complete data were summarized in Figure 2.
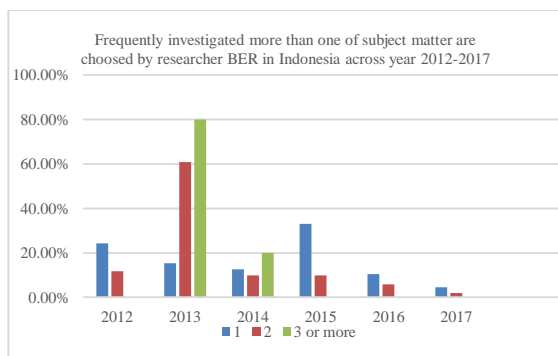

Figure 2. Frequently investigated more than one of subject matter were chosen by researcher of BER in Indonesia across year 2012-2017

This findings showed that the subject of research on "teaching" and "study of teaching materials" were the most widely used research subject in this study. The percentage for teaching subject were 35%. Then, the percentage for the study of teaching materials were 29%. This finding related to the study were conducted by Gul & Sozbilir (2015). Gul & Sozbilir's study showed that the the subject research were the comparison of methods, teaching effectiveness on attitudes, teaching effectiveness on learning outcomes or student achievement, teaching effectiveness on scientific process skills. This finding were similarity with other researchs were conducted by Chang *et al* (2010), Lee *et al* (2009), Sozbilir *et al* (2012) and Tsai & Wen (2005).

Frequently Used Research Design/Methods

The result about the investigation of BER design/method showed that quantitative have a significant percentage whent its compared to other methods, and its score were 49.35%. Then, its followed by Research and Development with score 39.85%. Then, qualitative with a score 0.54%, while the mixed method research method has the lowest percentage, as score 0.18%. These complete data were summarized in Table 3.

Table 3. Frequently used research design/methods by researchers in Indonesia across year 2012-2017

Research design		Research methods	f	(%)
Quantitative	Experimental	True-experimental	15	2.70
		Quasi-experimental	14	26.00
		Pre-experimental	4	13.00
			72	
		Single subject	0	0.00
		Factorial	0	0.00
		Sub-total	231	42.23
	Non-Experimental	Descriptive	11	2.00
		Causal-comparative	1	0.20
		Corelational	20	3.70
		Survey	5	0.91
		Ex-post facto	0	0.00
		Secondary data analysis	2	0.40
		Sub-total	39	7.12
Qualitative	Interactive	*Etnography*	0	0.00
		Phenomenogra	0	0.00

	phic		
	Case study	8	1.40
	Grounded theory	19	3.40
	Descriptive	28	5.10
	Critical studies	0	0.00
	Others	0	0.00
	Sub-total	55	10.05
Non-Interactive	Historical analysis	0	0.00
	Concept analysis	3	0.50
	Narative	0	0.00
	Biography	0	0.00
	Review	0	0.00
	Meta-synthesis	0	0.00
	Others	0	0.00
	Sub total	3	0.54
Mixed Method	Sequential	0	0.00
	Concurent	1	0.18
	Transformative	0	0.00
	Sub total	1	0.18
Research and Development (R&D) or/and educational design research (EDR)	Plomp model	2	0.40
	4D-model	97	18.00
	Borg & Gall model	44	8.00
	Others	75	13.58
	Sub total	218	39.85
	Total	**547**	100%

The frequently used research design / methods of BER in Indonesia across the year 2012-2017 were summarized in Figure 3.
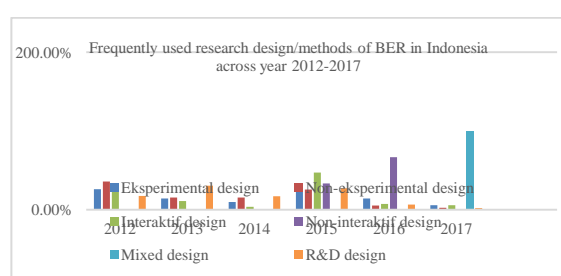

Figure 3. Frequently used research design/methods of BER in Indonesia across year 2012-2017.

In this study was also showed that the experimental design was the main choiced by researchers across the year of 2012-2017. The second most choice was non-experimental and interactive design. At mixed designs, across the year of 2012-2016 there were not researchers has chosed mixed designs. In other findings showed

that research and development being the most design chosen by researchers in 2013, and its score was 30.27%. But, across the year 2016-2017 this design returned to a design that was slightly chosen by researchers. These finding indicated that (a) when the researchers choose the experimental design, them still want to test hypotheses about the use of methods, strategies, media, curriculum or other interventions. (b) Research and development design became a trend in 2013, because before this year Indonesian schools used the Education Unit Level Curriculum (KTSP) (Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 22 of 2016). This curriculum contains more cognitive aspects than skills and attitudes, so that various types of learning resources are needed in schools. Furthermore, many schools in Indonesia lack good and varied learning resources. These conditions were the main reason for BER researchers in Indonesia to develop media and learning resources or intervention with research and development or/and educational design research (Plomp, 2010; Haviz, 2013).

After year 2013, elementary and secondary schools in Indonesia still has implemented K-13. The K-13 characteristic was applied to balance cognitive, affective and student skills. The integrated thema was more widely used in learning. The Government of the Republic of Indonesia has also supplemented learning resources, such text books, media etc. These conditions were cause the use of the R & D design to be not widely selected by BER researchers. The researcher returned to do more research on the use of learning strategies to improve student learning outcomes in the classroom, or many researchers chose mixed method to conduct the research on the implementation of K-13 in biology learning in Indonesia.

The research was conducted by previous researchers also explained that quantitative methods were preferred at the university level. In general, while qualitative research and mixed methods were less desirable in research used at universities (Derman, 2017). Quantitative research methods were also used in other research, such as the research were conducted by Gul & Sozbilir (2015),

Lee *et al* (2009), Çalık & Sözbilir (2014) and Erdogan *et al* (2013). These articles explained that quantitative research methods were more often used in research because it is easier to use statistics and compare with past data from the previous researchs.

Frequently Used Research Element

The result about the investigation of the elements of the Indonesian BER research across the year 2012-2017 have been summarized in Table 4. The data in Table 4 showed that the researchers in the field of education and learning biology in Indonesia tend to chose cognitive as an element of research. The number of articles containing cognitive elements were 478 (64%). Sequentially, the element of the research chosen by the researcher was affective with the number of articles were 115 (15.10%), psychomotor number of articles were 111 (15.00%), motivation with the number of articles were 24 (3.20%), while for spiritual get the lowest percentage with 0.8%, for other research elements not included in the PCF were 1.7%. Frequently used more than one research element of BER in Indonesia across year 2012-2017 were summarized in Figure 4.

Table 4. Frequently used research element of BER in Indonesia across year 2012-2017

Research element	f	%
Cognitive	478	64.00
Afective	115	15.10
Skill	111	15.00
Motivation	24	3.20
Spiritual	6	0.80
Others	13	1.70
Total*	747	100

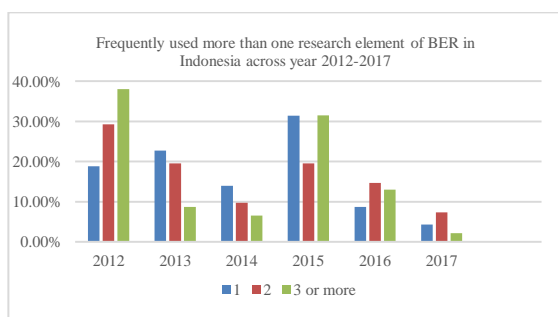*Some researcher chose more than one research element

Figure 4. Frequently used more than one research element of BER in Indonesia across year 2012-2017

Frequently Used Data Collection Tools

The result about the investigation of data collection tool used by researchers in the field of biology education and learning in Indonesia were summarized in Table 5. The result of this study showed that the instrument of test were the most tools has chosen by the researchers. There were 323 articles or 27.20% used the achievement test. There were 255 articles or 21.20% used the observation sheet. There were 119 articles or 10.00% used the alternative assessments. There were 117 articles or 9.80% used documents. There were 64 articles or 5.40% used interviews, and there were 23 articles or 1.50% used other data collection tools. Thus, the total data collection tools used by researchers in the field of education and learning biology in Indonesia were 1196 articles. However, there were the researchers that used more than one data collection tool. The results of the investigation of the frequency of data collection tools more than one used by BER researchers in Indonesia across year 2012-2017 were summarized in Figure 5.

Table 5. Frequently used data collection tools BER in Indonesia across year 2012-2017

Type of data collection tools		f	%
Quistionnaires	Open-ended	7	13.00
	Multiple choice	8	6.90
	Linkert type	8	5.00
	Others	0	0.00
	Total	23	24.90
Achievement test	Open-ended	59	4.90
	Multiple choice	249	21.00
	Others	15	1.30
	Total	323	27.20
Interviews	Structured	0	0.00
	Semi-structured	33	2.80
	Unstructured	29	2.40
	Others	2	0.20
	Total	64	5.40
Observations	Participant	181	15.00
	Non-participant	74	6.20
	Total	255	21.20
Alternative assesment tools	Port-folio	1	0.10
	Diagnostic test	0	0.00
	Concept map	1	0.10
	Validation sheets	117	9.80
	Total	119	10.00
Documents		117	9.80
Others		23	1.50
	Total*	1196	100

*Some of data collection tools are marked more thans on sub instrument

In Table 5 also showed that the multiple choice test was chosen most by the researchers, and its score were 249 articles or 21.00%, and its followed by the participant data collection collection tool, and its score were 181 articles or 15.00%. This finding showed that multiple choice tests as the most preferred of the collection data tool were choosen by researchers. Because, that multiple choice tests was easier to understand than others. This finding similiarity with other researc has conducted by De Jong (2007). In this study also showed that the alternative assessment was a tool that its very rarely used by researchers. In this study also showed that the portfolio and diagnostic tests were only used by one researcher, while there is no concept map for researchers to use them. This study also showed that the use of the questionnaire was quite fast, and that a lot of data can be collected easily, but the using of the questionnaires cannot provide information about the arguments given by the participants of the research. This information can be collected in different ways such as multiple choice questions, and its make the students can explain their answers (Gul & Sozbilir, 2015).
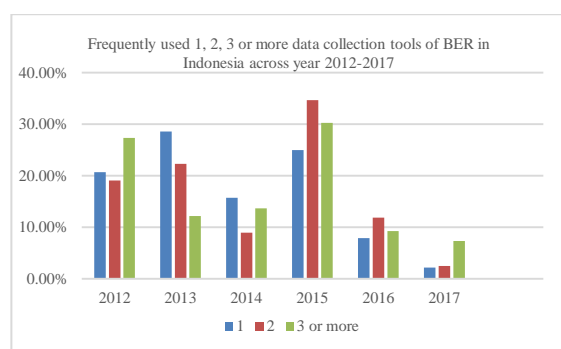

Figure 5. Frequently used 1, 2, 3 or more data collection tools of BER in Indonesia across year 2012-2017

Frequently Studied Samples And Sample Sizes

The result about the investigation of the sample of the research showed that the students of high school (SMA) was research sample chose by the researchers, and its score were 392 articles or 72.00%. There were 120 articles or 22.00% used students in junior high school (SMP). There were 14 articles or 2.60% used students in higher education. There were 17 articles or 3.10% used educators/teachers and only 2 articles or 0.40%

used students in elementary school. The complete data was written in Table 6. These findings were similarity with the findings of the research has conducted by Sozbilir et al. (2012). This study showed that the trend of sample was derived from the researchers' ideas, because the researchers were more likely to conduct studies with easy-to-obtain samples, the secondary school-based biological material more comprehensive and detailed. And also, the reason of the researchers choose the sample was the suitability of the sample with the type of research being carried out (Gul & Sozbilir, 2015).

Table 6. Frequently studied samples of BER in Indonesia across year 2012-2017

Sample	f	%
Pre-school	0	0.00
Primary	2	0.40
Junior High School	120	22.00
Senior High School	392	72.00
Undergraduate	14	2.60
Educators	17	3.10
Parents	1	0.20
Administrators	0	0.00
Others	1	0.20
Total	547	100

In this study, the size of samples between 31-100 were used 265 articles or 48.00%. The size of samples between 11-30 were used 192 articles or 5.00%. The size of samples between 1-10 were used 59 or 11.00%. The size of samples between 101-300 were 31 articles or 5.70%. There were not the researchers chose the size of sample research betweeen 31-100 and 11-30.The result about the investigation of the size of the samples of the research were written in Table 7. These finding showed that the researchers have considered that the selection of the size of sample research affects to the results of the study. The impact of the using of the small sample sizes in the study caused no differences in statistics or relationships with research, especially the large number of studies on education using a small sample size (Cohen et al. 2007). However, the use of small sample sizes causes the emergence of disturbing variables in a study (Gul & Sozbilir, 2015).

Table 7. Frequently studied sample sizes of BER in Indonesia across year 2012-2017

Sample sizes	f	%
Between 1-10	59	11.00
Between 11-30	192	35.00
Between 31-100	265	48.00
Between 101-300	31	5.70
Between 301-1000	0	0.00
More > 1000	0	0.00
Others	0	0.00
	547	100.00

Frequently Used Data Analysis

The result about the investigation of the data analysis were written in Table 8. Table 8 showed that the researcher chose the quantitative techniques, and its score were 422 articles or 68.00%. There were 199 articles or 32.00% used the qualitative techniques. If examined more deeply, many researchers used descriptive statistics to carry out the data analysis techniques in their research results. There were 171 articles or 28.00% used the descriptive statistics. T-tests and anova / anacova were the most widely used inferior techniques by the researchers, and its score were 150 articles or 24.00%. There were 22 articles or 3.5% used Anova/Anacova. Furthermore, there were 186 articles or 30.00% used percentages, and only 1 article or 0.20% used a content analysis. These result were similarity with the others findings. The researchers were more likely to used quantitative descriptive, inferential and content analysis as analysis of research data (Gul & Sozbilir, 2015).

Table 8. Frequently used data analysis methods of BER in Indonesia across year 2012-2017

Data analysis		f	(%)
Descriptive	Table frequently	43	6.90
	Charts	13	2.10
	Central tendency	2	0.30
	Percentage	171	28.00
	Sub total	229	37.30
Inferential	T-test	150	24.00
	Correlation	1	0.20
	Factor analysis	2	0.20
	Regression	4	0.60
	Non-parametric test	0	0.00
	Anova/Ancova	22	3.50
	Manova/Mancova	1	0.20
	Others	13	2.10
	Sub total	193	30.70

Qualitative	Content analysis	1	0.20
	Descriptive analysis	186	30.00
	Others	12	1.90
	Sub total	199	32.00
	Total	621*	100.00

*Some articles used more than one data analysis methods

At Figure 6, another finding about the trend of data analysis types in 2012-2017 showed that the inferential statistics were the most preferred data analysis technique in 2012, 2015, 2016 and 2017. While in 2013 and 2014 the inference became the smallest technique chose to be used to analyze data by the researchers. In 2013 and 2014, the inferential statistics and qualitative analysis were used more by BER researchers in Indonesia. These were allegedly because in 2013 and 2014, there were many researchers chose research and development methods. This method used the descriptive statistics and the qualitative analysis to analyze data.
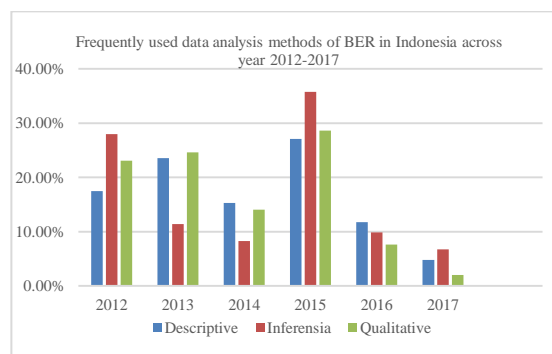

Figure 6. Frequently used data analysis methods of BER in Indonesia across year 2012-2017

Based on these findings, it can be concluded that the tendency of researchers to chose the biological material used in research were material about animals and their functions, and environmental and ecological material. The trend of the researchers in choosing research subjects in research was the subject of teaching and study teaching materials research. Then, in terms of research methods the trend of the researchers used the general method was quantitative methods and research and development or/and educational design research methods, where for quantitative research methods the trend of the researchers used quasi design experiment, while for research and development methods researchers tend to use the 4-D model in development research.

The trend of researchers was choose elements of research was cognitive (knowledge), affective (attitude) and psychomotor (skills) research. Data collection tools that tend to be used in a study were tests in the form of the multiple choice, participant observation, and questionnaires, based on the research sample that tends to be used in the study is a sample of high school and junior high school, while based on the size of the study sample more likely to use 31-100 samples and 11-30 research samples. Data analysis that tends to be used by researchers in their research is generally quantitative and qualitative data analysis, where for qualitative, descriptive analysis was more likely to be used by researchers, while for quantitative descriptive statistics more likely to be used descriptive percentages, for quantitative inferential statistics were more likely to be used T-test.

CONCLUSION

The trend in biology education research from 2012 to 2017 were (a) the topics was **a**nimal form and function; (b) the subjects matter was teaching and learning; (c) the research design/methods was quantitative experimental design; (c) the element of the research was cognitive; (d) the data collection tool was achievement test; (e) the sample research was studens in high school and the size of the sample research was 31-100; (f) the data analysis method was quantitative.

The implication of this study has implicated that to be an information for the researcher being conduct their researchs. The result of this study also will be contributed for the teachers and educator in teaching and learning of research of methodology in biology education. This study only used the four journal were indexed by IPI and this study was not concern the other articles that published in other journals. This condition was the limitation of this study. We argue that there were more articles must be subjected to the content analysis by the using oh this PCF. The next study will be completely the finding of this study.

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