

Achievement of the Program Outcomes in Outcomes Based Education Implementation - A Meta-Analysis

Yuzainee Md Yusoff
Universiti Tenaga Nasional, Malaysia

Norain Farhana Ahmad Fuaad, Ruhizan Bt. Mohammad Yasin and Norngainy Mohd Tawil
Universiti Kebangsaan Malaysia

Abstract

Outcome-Based Education has been gaining popularity during the 1980s and early 1990s. This approach is one of student-centered learning methods that focus on measuring student performance. Large numbers of students in several countries have adopted Outcome-Based Education. Therefore, the main purpose of this study is to investigate and present a meta-analysis that combines the findings from existing research and empirical evidences on the program outcomes achievement of the outcomes based education approach. A total of 20 published studies with 16160 numbers of samples generated an average effect size of 0.968365 with a standard deviation of 2.1084. There was little variation due to different research design, but the study neither separated studies according to their methodology nor fiddled with any statistical outcomes for the corresponding effect sizes. The findings revealed that the students' achievement on the program outcomes showed large effect sizes based on students' achievement on program outcomes through OBE approaches.

Keywords

Outcomes based education, achievement, engineering education, meta-analysis and effect sizes.

1. Introduction

Your Malaysia higher education has embraced Outcome-Based Education (OBE) since 2003, joining the others: the United States, the United Kingdom, Australia, South Africa, Chile and many other countries as well. OBE offers a powerful and appealing way of reforming and managing medical education (Harden et al. 1999) and outcome assessment has become the popular words of the 1990s (Tamblyn 1999). The concept of educational accountability was one reason for the rapid spread of various forms of outcomes-based education in countries such as Australia, the United States and the United Kingdom during the 1980s and 1990s (Killen 2000). The OBE is not just educational approaches option, but a crucial part of general education particularly in teaching and learning process. OBE is an approach that focuses on outcomes, where the achievements of students are measurable, proven and can be improved (Karman et al. 2011). OBE increasingly adopted by institutions of higher learning as practicable, effective and creative routes towards the acquisition of positive learning experiences. Some of the immediate effects and advantages of an OBE are (1) universities are always alert and concerned about the quality of the graduates produced; (2) development of more systematic, innovative and flexible teaching methods, for example, project based learning within an integrated learning environment, etc. will be encouraged; and (3) increase in student exposure to professional practice through industrial training, site visits and industry linked projects or assignments will be encouraged (Basri et al. 2004).

However, the process of educating and convincing academicians on the merit of OBE is a difficult one as many are quite satisfied with the current practices (Basri et al. 2004). Basri et al. (2004) and Chan & Chan (2009) reported that some of the academicians claimed that they had been employing the approach all along, but they actually do not really understand the whole concept of OBE. In addition, Basri et al., (2004) also emphasized on the Continuous Quality Improvement (CQI) as part concept in the OBE approach. Started from the formulation of the curriculum until the execution and implementation of the program, CQI must be in place continuously. The realization of the insufficiency of current systems and the desire for improvement is the fundamental of CQI process. The CQI included the opinion from stakeholders as they are at the receiving end of the educational process (Basri et al. 2004) and the achievement of the implementation of OBE (Malcolm 2001; Mansor et al. 2008; Shuaib et al. 2009; Anuar

et al. 2009; Mohayidin et al. 2009; Hashim, & Hashim 2010; Karman et al. 2011; Tang et al. 2012; Hassan 2012). Among the controversy raised are the attainments in implementing the OBE, its impact on students and lecturers, and its effect on the whole education system (Tang et al. 2012). By implementing of OBE, the students and graduates are expected to be able to take challenging tasks such as able to manage projects, analyze data, make decisions (Ismail et al. 2010; Karman et al. 2011), and function in multi-disciplinary teamwork (Ismail et al. 2010). In view of the importance of properly implementing OBE, this study aims to investigate the size effect and present a meta-analysis that combines the findings from existing research and empirical evidences on the program outcomes (PO) and learning outcomes (LO) achievement of OBE approach in the teaching and learning process of a higher education institution or Malaysian education.

2. Outcome-based Education (OBE) and Definitions

OBE, like most of the concepts in education, has been defined in many different ways but within the same concept that is by determining what needs to be achieved and attained the learning outcomes (LO). The ideas of OBE can be traced as far back in 1980s until more recently to newer models of curriculum development (Bloom 1956; Spady & Marshall 1991; Bouslama et al., 2003; Walid et al. 2012; Baba et al. 2012). OBE can be described as a comprehensive learning-teaching system which focuses on the learner's action-performance and output at the end of learning experiences. In other word, OBE is a method of curriculum design and teaching that focuses on what students can actually do after they are taught (Spady 1988; 1993). The details on explanation of the theory foundation and keystone of OBE is given by Spady (1994, 1998). Spady had been acknowledged as the person to have made a significant contribution to OBE where the ideas have had considerable influence on the approach to OBE and Spady also considered as the world authority on OBE (Killen 2000) and the father of OBE (Berlach & O'Neill 2008).

There is no absolute agreement on defining OBE, however the definition given by various studies has one basic principle, that is the OBE focuses on LO in preparing the students for professional practice and requires the program to be documented the evidence of achievement. The main ideas of OBE definitions come from Spady's definition. Following are ten various definitions of OBE (Table 1).

Table 1: Definition of OBE

Author(s)	Definition/ Description of OBE
1. Brandt, (1992)	OBE is teaching and learning targeting outcomes of knowledge, competence and orientation. Orientation is considered the affective and attitudinal dimensions of learning.
2. Spady (1994)	OBE is "... comprehensive approach to organizing and operating an education system that is focused in and defined by the successful demonstrations of learning sought from each student"
3. Spady (1994)	Outcome-Based Education means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences. This means starting with a clear picture of what is important for students to be able to do, then organizing the curriculum, instruction, and assessment to make sure this learning ultimately happens
4. Spady (1994)	OBE is 'an educational process which is based on trying to achieve certain specified outcomes in terms of individual student learning. Thus, having decided what are the key things students should understand and be able to do or the qualities they should develop, both structures and curricula are designed to achieve those capabilities or qualities.
5. Western Australian Education Dept. (1997). In Willis & Kissane (1997)	Educational structures and curriculum are regarded as means not ends. If they do not do the job they are rethought'
6. Gerber (1997)	Outcomes-based education is an educational philosophy that is organized according to certain basic beliefs, principles and essential features
7. Killen, 2000	OBE is an approach to planning, delivering and evaluating instruction that requires administrators, teachers and students to focus their attention and efforts on the desired results of education—results that are expressed in terms of individual student learning. (Main idea behind Spady's definition)
8. Lundie (2008)	OBE is "an approach in which the teachers and students focus their attention on two aspects. First is the emphasis on the desired end results of each learning process. This desired end results are called outcomes and learners must be able to demonstrate that they

	have achieved. Secondly, the emphasis is on the teaching and learning methods that will lead learners to achieve these outcomes”
9. Helen (2011)	OBE as “ ... an educational process that is focused on achieving certain specified outcomes in terms of individual student learning. Outcomes are key things students should understand and be able to do or the qualities they should develop
10. Acharya, C. (2003).	OBE is a method of curriculum design and teaching that focuses on what students can actually do after they are taught.
11. Barr et al., 2006; Mansor et al., 2008	Outcome-Based Education (OBE) is an educational approach that focuses on the graduate attributes or outcomes after completing an academic programme.

3. Rationales for Employing OBE Approaches

There are six rationales for selecting the outcomes-based education in the learning process that came from several sources such as political, economic and educational (Killen, R., 2000; Jonathan and Yusuf, 2001;). Table 2 presents the details of six rationales for selecting OBE.

Table 2. Six rationales for the studies

Arguments	Rationales
1. Social	To improve equity and distribution opportunities in multicultural or economically diverse nations, and build democratic participation, cultural expression and national identity.
2. Economic	As both nations shift their economic bases from primary production to value-added production. The shift requires new outcomes of education, emphasizing, for example, competence, creativity, self-management and teamwork, rather than the knowledge acquisition that dominated in the past.
3. Management	To enable greater effectiveness and efficiency in schooling (for all learners), guide management decisions within the system and increase the accountability of teachers, schools and the system.
4. International trends	Towards complex performance as the desired outcomes of education, and outcomes-based approaches as ways of managing education.
5. Education, training and lifelong learning	To provide better articulation between schools, vocational education and adult education.
6. Political reason	Arising from the nation’s immediate history and current political context

Source: Jonathan and Yusuf (2001).

Despite of numerous researches on OBE, there is little consent among educators regarding the achievement of PO. Hundreds of documents such as journals, articles, books and reports are found to be committed to issues related to the OBE including several studies put emphasis on the evaluation and achievement of PO. Many articles present on the design and implementation of OBE in their institutions. In addition, many studies were conducted to investigate the achievement of OBE implementation, and what is the impact on the students' capabilities in all disciplines of study. In many academic educational articles, few other terms instead of OBE have been used, such as outcome-based learning - OBL (Lee et al. 2009; Esmaily et al. 2009; Wang 2011; Najjar et al. 2011), outcome-based teaching and learning-OBTL (Wong & Cheung 2011a; Biggs, & Tang, 2007) and outcome-based approach – OBA (Wong & Cheung, 2011b). Few examples of the documents are the study conducted by Wong and Cheung (2011b) on evaluation of outcome-based approach (OBA), Wang (2011) on designing and implementing OBL, Mohayidin et. al. (2009) and Karman (2011) on designing and implementing OBE, Baba et al. (2012) on alumni feedback on outcome based education, Ismail et al. (2010) and Tang et al. (2012) on implementation and assessment of OBE and many more to articulate. There are few studies on the achievement Program PO and LO of the selected degree program. This study employed a meta analysis to find the effect size measure, *d* of the achievement of the PO or LO of OBE approach in those studies.

4. Objectives

This article describes a meta-analysis that summarizes the available empirical evidence to date on achievement of the PO or/and LO in OBE implementation. The objectives of this study are as follows:

- Collect and summarize the evidence on the achievement of the PO or/and LO in OBE implementation.
- The study will observe whether the OBE approaches have generally found to be effective by investigating the PO or/and LO achievement implemented in OBE approaches. This includes on how effect sizes vary

with PO or/and LO measures, expecting that the impact of implementation of OBE is significant to the PO and LO achievement.

A meta-analysis that combines the findings from existing research and empirical evidences on the PO or/and LO achievement will be employed in this study.

5. Methodology

5.1 Literature Search Strategies and Data Sources

Bullet a substantial literature search was designed to identify and retrieve primary empirical studies relevant to the purpose of this study. Search results span the 1992 through 2013, although the entire year of 2013 has not been searched, as the final searches occurred in 2013. The databases searched were SciencesDirect, ERIC, ProQuest Dissertations and Theses, Scopus, JSTOR, Emerald Full text, ISI Web of Science, EBSCOHOST, eBook Collection (EBSCOHOST). Although the bulk of studies has likely already been identified, in the next stage of this project, all searches will be updated and further searches will be conducted in the following sources: various databases available in the UKM library and various Web search engines, including Google and Google Scholar. The articles and previous meta-analyses were scrutinized. A total of 30 studies was found.

The descriptor *Outcome-based education* was used when possible; otherwise, it was searched as a keyword. All results were limited to empirical studies when possible or the above mentioned search statements were combined with the keywords: “outcomes based education”, “learning outcomes”, “program outcomes”, “achievement” and “educational approach”.

5.2 Criteria for Inclusion

The selections of article were based on reading the full text of the article. The decision was made by authors who work independently then met to discuss their findings and judgements. The studies were identified from an initial reading of primary and secondary sources related to the definition of OBE and the students’ achievement of program outcomes or/and LO in implementing OBE approaches. The following inclusion criteria were used:

- Accessibility - The studies available or achieved publicly. However, the search was limited to keywords “outcomes based education”, “learning outcomes”, “program outcomes”, “achievement” and “educational approach”.
- Relevancy - The study on:
 - o definition of OBE published between 1992 until 2013;
 - o achievement of the PO or/and LO based on OBE approaches in education, published between 2000 and 2013;
- Quantitative data sufficiency - related dependent variables are reported in a way that enables to calculate estimated effect size.

5.3 Meta-analysis Method

The study employs a meta-analysis that combines the findings from existing research and empirical evidences in order to analyse the results from individual studies for the purpose of integrating the findings of the PO achievement. Meta-analysis techniques have been widely used in the education, behavioural sciences, medical, biological, psychology economics and management, and are rapidly being adopted in other fields too. Meta analysis refers to the analysis of analysis, the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings (Wolf, 1986). In addition, Qiu-ying et al. (2009) emphasized that, by contrasting and combining results from the existing studies, meta-analysis can give general conclusions to resolve the controversy in previous research, improve the statistical power of research findings, point out research directions for future studies, and find out moderating factors in a specific relationship. Gao et al. (2012) pointed out that meta-analysis is the quantitative accumulation and analysis of effect sizes and other descriptive statistics across studies. They also highlighted that the method is to analyse a literature using statistical procedures and econometric techniques that enables valid inferences to be drawn and finally help to validate the key relationships (Gao et al. 2012). Hence, a meta - analysis method can make quantitative generalizations across empirical studies on the related subject to achieve the required goal. The meta-analytic analysis employs in this study has one main goal that is to provide an estimate of the effect size for the achievement of PO and LO of OBE. Effect size quantifies the size of the difference between two groups, and may therefore be said to be a true measure of the significance of the difference (Coe 2002).

The study attempts to identify patterns among study results, sources of disagreement between those results, or other interesting relationships, if any, in the context of multiple studies. Twenty out of fifty studies found included in this meta-analysis provided the different research designs. Statistical data from each study were recorded, including mean scores, standard deviation, chi square, t-value, and p-value. These values were converted to an effect size metric by using the conversion formulas as employed by Becker & Park (2011) in their study. Table 3 presents conversion statistical formulas used to calculate the effect sizes.

Table 3. Conversion statistical formulas used to calculate the effect sizes.

Given Statistics Data	Formulas
Mean and standard deviation in one group	$\frac{\bar{X}_{post} - \bar{X}_{pre}}{SD_{pre}}$
Mean and standard deviation in each group (two groups posttest only)	$\frac{\bar{X}_E - \bar{X}_C}{SD_C}$
Mean and standard deviation in each group (two groups pre-post test)	$\frac{(\bar{X}_{post} - \bar{X}_{pre})_E - (\bar{X}_{post} - \bar{X}_{pre})_C}{\frac{SD_{preC} + SD_{preE} + SD_{postC}}{3}}$
Given Chi-square	$\frac{2r}{\sqrt{1-r^2}}, \quad r = \sqrt{\frac{\chi^2}{n}}$
Given t-value	$t \sqrt{\frac{1}{n_E} + \frac{1}{n_C}}$
Given p-value	CMA

Source: Becker, K. H., & Park, K. (2011)

The output of a meta-analysis might be a weighted average related to the sample sizes within a single study. An individual effect size was calculated and presented in order to observed the effects of OBE approaches among PO or/and LO. The guidelines for interpreting effect sizes presented in Table 4.

Table 4. Interpretation of effect sizes

Small effect	Medium effect	Large effect
$ES \leq 0.2$	$0.2 < ES < 0.8$	$ES \geq 0.8$

According to Cohen (1988).

5. Results and Discussion

Table 5 presents twenty findings of studies related to PO and LO achievement. The second last column of Table 5, presents the output of meta-analysis with an effect sizes for twenty studies. Meanwhile Table 6 presents a summary on the effect sizes obtained by 20 studies.

Table 5. Major features of twenty studies

Study / Source	N	Mean/ SD / % or P-value	Grade Level	Course/ subject	Achievement	Effect Size	Code
1. Chong, B. K., & Crowther, F. (2006).	N(S) = 192 N(E) = 20	Mean (S) = 2.772222 SD (S) = 0.211292 Mean (E) = 2.472222 SD (E) = 0.325107	University	Achievement of Learning Outcomes of the Programme as perceived by students and employers	Score evaluated by students and employers	-1.4198	C1
2. Mansor, W., et al. (2008).	273	Mean = 60.668 SD = 2.330326 $\chi^2 = 0.776553$ $r = 0.046999$	University	Digital System and Microprocessor (ECE511)	Average Score for PO's	0.094102	C2

Study / Source	N	Mean/ SD / % or P-value	Grade Level	Course/ subject	Achievement	Effect Size	Code
3. Amirul ddin, U., Anisa et. al. (2009)	3390	BEEE Sem 1 2007/2008 Mean = 81.277 SD=6.747791 BEEE Sem 2 2007/2008 Mean =86.48 SD=5.473969	University	BEEE program in UNITEN	Score for PO's achievement 2007 / 2008	0.771067	C3
4. Amirul ddin, U., Anisa, et. al. (2009)	3112	BEEE Sem 1 2008/2009 Mean = 85.962 SD=6.833569 BEEE Sem 2, 2008/2009 Mean = 91.618 SD =5.040275	University	BEEE program in UNITEN	Score for PO's achievement. 2008 / 2009	0.827679	C4
5. Amirul ddin, U., Anisa, et. al. (2009)	2448	BEPE Sem 1 2007/2008 Mean = 85.848 SD= 8.208912 BEPE Sem 2 2007/2008 Mean = 86.793 SD= 5.305241	University	BEPE program in UNITEN	Score for PO's achievement 2007 / 2008	0.115119	C5
6. Amirul ddin, U., Anisa, et. al. (2009)	2333	BEPE Sem 1 2008/2009 Mean = 85.778 SD= 6.846833 BEPE Sem 2, 2008/2009 Mean = 89.345 SD = 7.926879	University	BEPE program in UNITEN	Score for PO's achievement 2008 / 2009	0.520971	C6
7. Lee Y.K. et. al. (2009);	90	Mean =47.335 SD=17.303 $\chi^2=0.2317$ $r=0.0273$	University	Control System Design Course	Average Score for PO	0.0546	C7
8. Zainol Abidin, H., et. al. (2009)	13	Mean =74.01333 SD=4.260876 $\chi^2=0.1133$ $r=0.031424$	University	Electrical Engineering Laboratory 2 (EEE361)	POs average score on Laboratory Analysis Performance	0.062879	C8
9. Horiuchi, S., et. al. (2009).	70	Mean: 76.2 t: 0.66 df:68 p-value: 0.51 n1 =37 n2=33	College	Nursing education	Percentage of learning outcomes via web-based learning as compared to traditional face-to-face learning	0.15803	C9
10. Shuib N. H. et. al. (2009)	3493	Mean =57 SD =5.395 $\chi^2=0.7896$ $r=0.0134$		Bachelor of Mechanical Engineering	overall PO attainment	0.0267	C10
11. Esmaily, H. M, et al.	58	Pretest Intervention Mean = 22.2 SD = 4.6	University	Achievement of learning outcomes for general	Mean score of achievement on learning	3.213	C11

Study / Source	N	Mean/ SD / % or P-value	Grade Level	Course/ subject	Achievement	Effect Size	Code
(2009)		Post test Intervention Mean = 37.3 SD = 3.8		physicians using OBE approaches	outcomes		
12. Hashim, N., & Hashim, H. (2010).	35	Mean =72.91667 SD =1.568991 $\chi^2 = 0.226687$ $r = 0.038317$	University	Final Year Degree Project, Faculty of Electrical Engineering, UiTM	Average Score for PO's	0.07669	C12
13. Naim, N. F., et. al. (2010)	18	Mean = 68.84833 SD= 7.303294 $\chi^2 = 0.361249$ $r = 0.035595$	University	Laboratory Analysis Performance Electrical Engineering Lab 4 (EEE462)	POs Percentage Achievement	0.071235	C13
14. Ab Rahim, A. et. al. (2010)	72	Mean = 53.14333 SD =4.205 $\chi^2 = 0.0297$ $r = 0.00350$	University	Modern Control Systems in Electrical Engineering course	Average Score for PO's	0.007	C14
15. Ismail, A. M., et.al. (2010).	Not stated	Dec 2008 Mean =69.66 SD = 16.61 July 2009 Mean =68.87 SD =11.86	University	Outcome of Diploma in Civil Engineering Program.	Average percentage Program outcomes	-0.0476	C15
16. Eng, T. H. et al. (2012)	45	Entrance; Mean =2.4856 SD = 0.54587 Exit: Mean =3.1020 SD = 0.31636	University	OBE incorporating technology innovation	OBE grade score and OBE-student centered learning average score	1.1255	C16
17. Akir, O., et al. (2012).	45	$\mu_{OBE} = 2.4683$ SD=0.11031 P-value = 0.000 $\mu_{non-OBE} = 2.3636$ SD= 0.11095 P-value = 0.592	University	Social Sciences	Average score Program outcomes	0.943668	C17
18. Akir, O., et. al (2012).	44	$\mu_{OBE} = 3.0386$ SD=0.08037 P-value = 0.000 $\mu_{non-OBE} = 2.4359$ SD= 0.07479 P-value = 0.592	University	Sciences	Average score Program outcomes	8.058564	C18
19. Mutalib, A. A., et. al (2012).	363	Mean =46.4 SD =1.589 Chi-square =8.67x10 ⁻⁵ $r = 4.55 \times 10^{-6}$	University	Graphical Engineering Course (KF1173) 2005/2006	Average percentage scores	0.0000091	C19
20. Nordin R. et. al. (2012)	46	Year 3 (before IT) Mean = 3.718 SD = 0.067971 Year 4 (after IT) Mean =4.038 SD = 0.104976	University	Electrical & Electronic Engineering program Semester II, 2010/2011	average score on PO after industrial talk	4.70789	C20

The data of 20 effect sizes from 16 published articles suggest a general positive effect on the implementation of OBE in higher education institutions. The findings are not consistently positive, since there is evidence of negative effects. Eighteen studies have positive effect sizes and only two studies have negative effect sizes. Twelve studies

(Mansor, W., et al., 2008); Amirulddin, U., Anisa, et al., 2009; Lee Y.K. et al., 2009; Zainol Abidin, H., et al., 2009; Horiuchi, S., et al., 2009; Shuib N. H. et al., 2009; Hashim, N., & Hashim, H., 2010; Naim, N. F., et al., 2010; Ab Rahim, A. et al., 2010; Mutalib, A. A., et al., 2012) shows small effect with two out of it (Chong, B. K., & Crowther, F., 2006; Ismail, A. M., et al., 2010) reported negative effect sizes. Meanwhile, two studies reported by Amirulddin, U., Anisa, et al. (2009) have medium effect. Six out of twenty studies (Amirulddin, U., Anisa, et al., 2009; Esmaily, H. M, et al., 2009; Eng, T. H. et al., 2012; Akir, O., et al., 2012; Nordin R. et al., 2012) shows large effect sizes.

Table 6. Summary of effect sizes of twenty studies

Small effect	Medium effect	Large effect
$ES \leq 0.2$	$0.2 < ES < 0.8$	$ES \geq 0.8$
12	2	6

Figure 1 shows the final result of the effect sizes with a range from -1.4198 to 8.05864 and an average of 0.968365 with standard deviation of 2.1084. This indicates that the achievement of the PO or LO has large effect sizes, that is 0.968365 (large effect if $ES \geq 0.8$ - Cohen, 1988). The findings revealed that the implementation of OBE has a significant result on students' achievement. The assessment standards, tasks and procedures employed in OBE approaches should be fair to all students, as a result, students' achievement indicates the PO and LO achievement. This supported by Killen (2007) in his book, stated that assessment standards, tasks, procedures, and uses should be fair to all students and should be valid and appropriate representations of the standards students are expected to achieve.

With the implementation of OBE in the educational system, Program Outcome or Learning Outcomes can be measured thoroughly according to specific domain to identify student achievement. The data on the Program Outcome can be collected in every semester to observe the progress made by students, lecturers and the faculty. Although as presented in this paper the achievement of PO/LO do influence by sample size, but the data still can be used to identify any improvement that can be made for the course or subject.

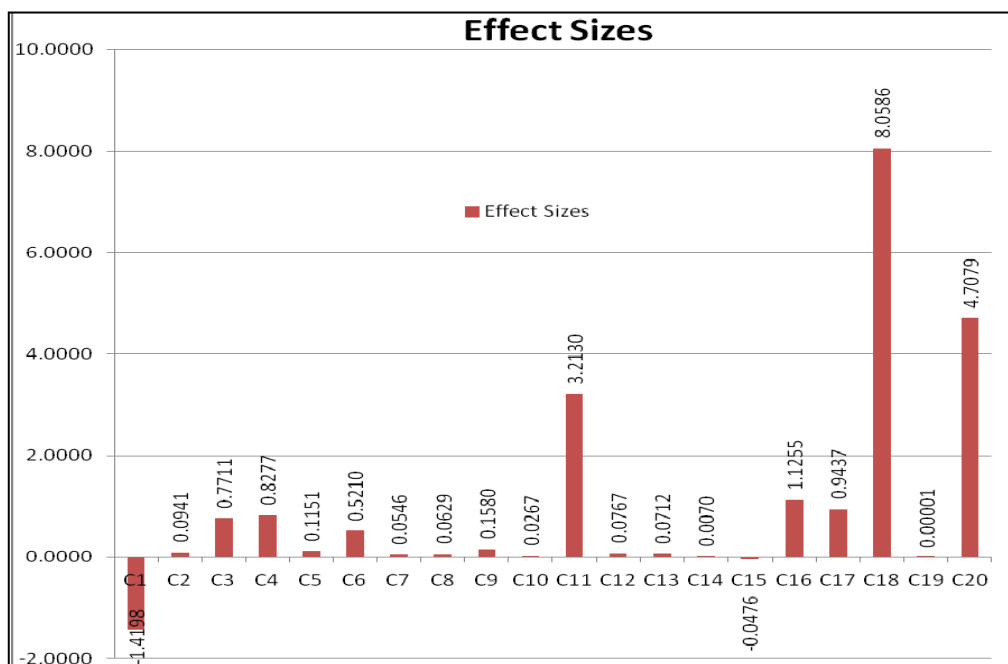


Figure 1. Twenty achievement effect sizes of sixteen studies.

6. Conclusion

In this paper, the findings of the meta-analysis of the achievement revealed that students' achievement on the PO and LO in the implementation of OBE in higher education institutions. It's shows large effect sizes (average of 1.574481) based on students' achievement in OBE implementation. Obviously, implementing OBE will become a trend in the higher education institution. Mainly, OBE implementation offered benefits to the academician and

students by highlighting the achievement of program outcomes and learning outcomes which shows the effectiveness of OBE system. The implementation of the OBE system needs to be done properly and with care to have high achievement of program outcomes and learning outcomes. In addition, the future study should focus on all higher education institutions in Malaysia to gather comprehensive and in-depth analysis of the PO and LO achievement in OBE implementation. The findings will help to better improve the quality of OBE implementation especially in Malaysia.

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Biography

Yuzainee Md Yusoff worked first 12 years as teacher at secondary school in Malaysia, followed by 3 years as a lecturer in the Universiti Teknologi MARA (University of MARA Technology - UiTM) before joining the Universiti Tenaga Nasional - UNITEN in the year 2006. She is lecturer of Department of Civil Engineering, College of Engineering, UNITEN and is currently Coordinator for the UNITEN Teaching and Learning Centre. She obtained her BSc (Mathematics) from Arkansas State University, Jonesboro, Arkansas, USA in 1988 and Msc (Mathematics) in 2003 from Universiti Kebangsaan Malaysia – UKM. Currently, she pursuing her study for Phd at Universiti Kebangsaan Malaysia – UKM in engineering education. She has until now published over 30 research papers in journals and conferences.