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Acceptance of Open Source Software Among UiTM Students: A Case Study of Diploma Level Computer Science Students in UiTM Johor

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ABSTRACT

This paper explores the issues of students' perception and acceptance level towards OSS among Diploma in Computer Science students. Furthermore, it is also to determine the potential factors that hinder students' perception and acceptance towards OSS and offer possible solutions to encourage the adoption of open source software in Malaysian computer science institutions. A total of 205 students from various classes and specialization fields were sampled. The overall results reveal that the students' exposure and acceptance is considerably average.

Keywords: Acceptance, Computer Science, Open Source Software, Perception

Introduction

As Computer Science educators we constantly seek new channels, methods, and technologies to reach and intrigue our students. We hope to first capture their interest, and then maximize their understanding and retention of the material, and finally encourage their own independent creative work. Throughout this process, we try to teach them skills that they can apply in the real world. The breadth of our field and the variety of pedagogical approaches make this process very difficult.

Open source software (OSS) is software where the source codes (the language in which the program is written) is freely distributed with the right to modify the code, and on the condition that redistribution is not restricted, and indeed is obtainable for no more than the reasonable cost of production. We believe that open source software can serve as a channel, method, and technology to teach and learn computer science. OSS has the potential to expand group work beyond the classroom to include much larger projects and more distributed teams. OSS can also be used to introduce our students to the larger computer science community and to the practice of peer-review. Finally, OSS can always provide us with free or lower-cost

technology in the classroom, permitting us to use technology that we might otherwise be unable to afford.

Most IT firms, ICT industry and government agencies nowadays are beginning to use OSS in terms of reducing cost of buying software licenses and moving towards OSS projects. The Open Source Competency Center Newsletter (MAMPU, 2008), reports that the number of government agencies adopting the Open Source Software has been increasing. Latest statistics show that 327 agencies have implemented OSS with over 936 known implementations. The tremendous increase of OSS adoption has led to a substantial need to increase the number of personnel with relevant OSS skills in the Public Sector.

According to Nur Hussein (2003), open source is the lever to open real-life software for students in Malaysia and empower them to create local and localized tools. However, as the open source movement gains momentum in institutions of higher learning in North America, South America, Japan, Australia and Europe, the rate of acceptance among Malaysian university students is still low despite the many benefits of open source.

Therefore, this paper attempts to explore the issues of students' perception and acceptance level towards OSS among Diploma in Computer Science students.

Scope

The scope of this research is limited to the acceptance level towards OSS among Computer Science students in Universiti Teknologi MARA Perak and Universiti Teknologi MARA Johor which consists of 205 respondents from various classes and knowledge in OSS.

Objectives

The objectives of the study are:

- a) to determine the students' perception on open source software
- b) to determine the students' acceptance level towards open source software.
- c) to determine the potential factors that affects students' perception and acceptance towards OSS

Significant

At the end of this study, it will show that the OSS environments is significant because it provide opportunities to reduce costs whilst nevertheless increasing the use of educational technologies in several ways. OSS does not require user licenses, so it is economically accessible for many institutions and individuals who cannot afford proprietary software. It is also a way to combat software piracy. The Open Source Competency Center Quarterly Newsletter (MAMPU, 2009) reports that MAMPU has revealed that total known licensing fee savings from OSS adoption in Public Sector is estimated to be approximately RM40 million. Furthermore, savings on licensing fee alone by adopting OpenOffice.org have already exceeded RM12 million

Review of Related Literature

According to Nur Hussein (2003), computer science students still have not explored the potentials and benefits of open source software due to main reason because the software still very unusable for novices, that steep learning curve of Unix- like environments discourage further exploration by students.

In other operational view, John E. Howland (2000), open source provides the software freedom to re-kindling some of the excitement and enthusiasm experienced in the early history of computing. Free and open sharing of ideas within the academia is highly and students can benefit from reading of source code of real programs written by great programmers and designers. This eventually can produce quality relationship between computer science curriculums with open sources and software freedom.

According to Carlos Machado (2005), open source can be useful and intuitive means of experimenting with different products, sharing ideas and finding technological solutions.

Another definition is by Coppola (2004), more over some of the fundamental reasons for spread of open source software are formed around diversity of input, recycling of ideas, and collaboration. These essential ingredients for innovation and present clear advantages for the development of software that presently contributing to the democratization and globalization of education and will help shape the virtual universities of tomorrow.

According to Bryan Pfaffenberger (2000), by establishing open source software as the international standard for academic computing, institutions of higher education can directly address challenges to the integrity of scientific research, preparing

students for a world of rapidly changing technology and combat the growing and disturbing disparities in access to information technology.

Furthermore, the literature (Vermeer, 1998) shows that students are more likely to be skill insufficient when using closed ended software and can be concluded that colleges and universities can well serve the goals of computer literacy education by moving to a open source software standard.

In other research by Vermeer (1998), at higher curricular levels, colleges and universities are arguably under a positive obligation to move away from closed software and proprietary computing infrastructures.

It could be synthesized by Watkins (1999), increasingly it is not only scientist who must understand the detailed of operating systems and computing networks; advanced research in computing virtually requires the type of intermediate to advanced understanding of information technology that will formerly possessed only by computer science graduates. In this context, open source operating systems and networking infrastructures offer a significant advantage: open to dissection, analysis, and scrutiny that always not possible with closed-source architectures.

Methodology

A questionnaire consisting of a questions pertaining to demographic information, OSS perception and acceptance level, and students' recommendation about OSS on learning were distributed to the students from various classes and levels of knowledge in OSS at Universiti Teknologi MARA Perak and Universiti Teknologi MARA Johor. The target respondents were Diploma in Computer Science students. Each of them answers 15 items in the questionnaire that address the issues of students' perception and acceptance level towards OSS in higher education institutions.

The questionnaire are divided into three main sections; first section gathered the demographic information of the students, while second section was to measure the student's exposure level towards OSS and the third section was to measure the student's acceptance level towards OSS.

For second section of the questionnaire, the students are expected to rate their exposure level of OSS using a five point Likert Scale, ranging from 1 (Strongly Agree), 2 (Agree), 3 (Neither Agree/Disagree), 4 (Disagree) and 5 (Strongly Disagree). As for the third section, the students are expected to rate their acceptance level of OSS using a Semantic scale that has been constructed, ranging from 5 (Very high), 4 (High), 3 (Moderate), 2 (Low) and 1 (Very low). For every respondent, the

scores are averaged (Mean) and ranked over a number of items tapping a particular factor or variable and finally summated.

Result and Findings

a) Students' Perception towards OSS

Table 1 shows the result of descriptive statistics for students' acceptance of the Open Source Software (OSS). The mean score for all the variables show that the respondents believe that knowledge and skills in OSS has given great advantages to Computer Science students. Although the mean score shows that the students' exposure and acceptance is considerably average, the respondents are fully aware of the OSS attracting factors and their refusal level of using OSS is considerably low (as compared to their belief on the advantages).

Table 1: The Descriptive Analysis of Each Factor

Factors	Mean	Mean Std. Error	Standard Deviation
OSS Advantages for CS	3.847	0.060	0.862
Students' Exposure and Acceptance	2.701	0.052	0.750
OSS Attracting Features	3.154	0.052	0.751
Students' Refusal Factor	2.442	0.055	0.790

N = 205

Table 1(a) shows the results of the cross group comparison of the mean score shown in table 1. Except for the students' exposure and acceptance of OSS, there is no significant difference between all groups of gender and parts. Although there is a significant difference in the mean score for the students' exposure and acceptance of OSS, it only happens in the comparison which based on gender.

Based on the above discussion, it is sufficient to conclude that all groups of respondents have the same thought over all the factors, thus evident the strong confident over the motion that Computer Science students have a good perception and confident on OSS.

Table 1(a): Cross Groups Comparison of the Descriptive Analysis of Each Factor

Factors	Comparison Between Independent Groups				Sig. of Difference
	Groups	Sub-Groups	Mean	Statistics	
OSS	Gender	Male	3.726	$t_{df=203, \alpha=0.05} = -1.672; p = 0.096$	✘
		Female	3.930		
Advantages for CS	Part	1	3.495	$F_{df=4,188; \alpha=0.05} = 2.274; p = 0.063$	✘
		2	3.823		
		3	3.933		
		4	4.138		
		5	3.793		
Students' Exposure and Acceptance	Gender	Male	2.925	$t_{df=203, \alpha=0.05} = 3.634; p = 0.000$	✓
		Female	2.548		
	Part	1	2.875	$F_{df=4,188; \alpha=0.05} = 1.546; p = 0.191$	✘
		2	2.522		
		3	2.546		
OSS Attracting Features	Gender	Male	3.155	$t_{df=203, \alpha=0.05} = 0.024; p = 0.981$	✘
		Female	3.153		
	Part	1	3.025	$F_{df=4,188; \alpha=0.05} = 2.237; p = 0.067$	✘
		2	3.079		
		3	3.242		
Students' Refusal Factor	Gender	Male	2.367	$t_{df=203, \alpha=0.05} = -1.128; p = 0.261$	✘
		Female	2.493		
	Part	1	2.482	$F_{df=4,188; \alpha=0.05} = 0.324; p = 0.862$	✘
		2	2.547		
		3	2.362		
		4	2.438		
		5	2.442		
$N_{Total} = 205$		$N_{Male} = 83$	$N_{Female} = 122$		
		$N_{Part01} = 31$	$N_{Part02} = 43$	$N_{Part03} = 47$	$N_{Part04} = 29$
					$N_{Part05} = 43$

b) Students' Acceptance Level

Table 2 shows the students' acceptance level of OSS. The descriptive analysis reveals that 71.7% of the respondents are using OSS, where majority of them (47.0%) have experience of less than 1 year. Only 12.8% have experience between 1 to 2 years, while the other 13.4% have experience more than 2 years.

For those who admitted using OSS, they stated that the main reasons of using OSS are due to (in descending order): (i) ability to alter the source code; (ii) convinced by the quality; (iii) it is free, and; (iv) ambition to defeat large software companies.

Majority of the respondents who are using OSS (59.7%) admitted that they have never attempted to alter source code of OSS, whereas only 6.7% admitted often, 25.5% sometimes and 8.1% seldom.

Table 2: Descriptive Analysis of Students' Acceptance Level

OSS Application Level	N	%
Not Using OSS	56	27.3%
Using OSS	149	71.7%
Experience of Using OSS		
Less than 1 year	70	47.0%
More than 1 year	19	12.8%
Less than 3 years	11	7.4%
More than 3 years	9	6.0%
Not responded	40	26.8%
Reasons of Using OSS		
Convinced by the quality	40	26.8%
It's free	37	24.8%
Ambition to defeat large software company	22	14.8%
Ability to alter the source code	41	27.5%
Learning new things / Extra knowledge	7	4.7%
University Requirements (for completing assignments)	2	1.3%
Experience of Altering Source Code of OSS		
Never	89	59.7%

Seldom	12	8.1%
Sometimes	38	25.5%
Often	10	6.7%

Although majority of the respondents (92.7%) admitted that they have personal computer with open source operating systems, almost half of them (46.8%) admitted that they don't have experience in open source operating systems. For those who do have the experience, majority of them used Linux.

Among the 92.7% of respondents who have personal computer with open source operating system, 59.0% of them admitted that they installed the open source operating system for the learning purposes, 24.4% are due to the university requirement for assignment, and only 9.3% are genuinely due to their preference on the operating system.

Table 3: Descriptive Analysis of OS Operating Systems Application Level

OS Operating Systems Application Level	N	%
No experience	96	46.8%
Have experience	97	47.3%
Linux	83	3.9%
Linux and NetBSD	8	4.7%
Others	6	2.9%
Have PC with OS Operating Systems	190	92.7%
Reason of having PC with OS Operating Systems		
Just for trying out / Learning	121	59.0%
Required for university assignments	50	24.4%
Like the OS Operating Systems	19	9.3%

Majority of the respondents prefer to have licensed software for: (i) development environment for C++; (ii) software compiler for CSC125; (iii) operating systems for CSC203; (iv) network operating systems for ITT320, and; (v) internet programming language for CSC317. Majority of them prefer OSS only for system software (for ITT320).

Table 4: Respondents' Preference of Software

Task	OS / LS	N	%	Comparison between Responses	Sig. of Diff.
Choice of Development Environment for C++	OS Software	13	6.2%	$\chi^2_{df=1, \alpha=0.05} = 114.173; p < 0.0001$	✓
	Licensed Software	149	71.3%		
	Undecided	47	22.5%		
Choice of Software Compiler for CSC125	OS Software	8	3.9%	$\chi^2_{df=2, \alpha=0.05} = 349.485; p < 0.0001$	✓
	Licensed Software	190	92.7%		
	Undecided	7	3.4%		
Choice of Operating Systems for CSC203	OS Software	59	28.7%	$\chi^2_{df=2, \alpha=0.05} = 117.129; p < 0.0001$	✓
	Licensed Software	127	62.0%		
	Undecided	19	9.3%		
Choice of System Software for ITT320	OS Software	110	53.7%	$\chi^2_{df=2, \alpha=0.05} = 67.006; p < 0.0001$	✓
	Licensed Software	71	34.6%		
	Undecided	24	11.7%		
Choice of Network Operating System for ITT300	OS Software	72	35.1%	$\chi^2_{df=2, \alpha=0.05} = 72.888; p < 0.0001$	✓
	Licensed Software	106	51.7%		
	Undecided	27	13.2%		
Choice of Internet Programming Language for CSC317	OS Software	69	33.7%	$\chi^2_{df=3, \alpha=0.05} = 94.810; p < 0.0001$	✓
	Licensed Software	89	43.4%		
	Undecided	47	22.9%		

Majority of the respondents are not sure of the popularity of OSS among Computer Science students. Only 16.1% of them believe that OSS is used by many Computer Science students, while another 17.6% believe it is not.

On the issue of the main obstacles toward acceptance, majority of the respondents (44.0%) believe that OSS is not user friendly and hard to use. They also believe that it is not used in the real life (18.2%), it has unattractive interface (17.2%), it is not business friendly (6.2%) and they do not have enough exposure to OSS (1.9%).

Table 5: Respondents' Perception over some Acceptance Issues

Acceptance Issue	Factors	N	%
Popularity of OSS among CS	Used by many CS	33	16.1%
	Refused by many CS	36	17.6%
	Balance	33	16.1%
	Not sure	101	49.3%
	No response	2	1.0%
Main obstacles toward acceptance (Minus)	Isn't user-friendly and hard to use	92	44.0%
	Isn't used in real world	38	18.2%
	Isn't business-friendly	13	6.2%
	Unattractive interface	36	17.2%
	Insufficient exposure	4	1.9%
	Not sure	26	12.4%
Main factors lead to acceptance	Self exploration	92	44.9%
	Eagerness to use alternative technology	80	39.0%
	Desire to reduce cost in buying proprietary software	27	13.2%
	Not sure	6	2.9%
Primary benefit to CS	It's free	66	32.2%
	Can learn from reading OS code	121	59.0%
	Not sure	18	8.8%
Give value added to CS	Yes	125	61.0%
	No	10	4.9%
	Undecided	70	34.1%

Pertaining to the main factors that lead to the acceptance of OSS, majority of the respondents (44.9%) believe that it comes from self exploration activities. They also believe that it is mainly caused by the eagerness to use alternative technologies (39.0%), and desire to reduce cost in buying proprietary software (13.2%). Majority of the respondents (59.0%) believe the primary benefits that they may get from OSS is that they can learn a lot from reading OS code, at zero cost (32.2%).

Respondents also believe that knowledge and skills in OSS can give value added to them (61.0% agreed, while 4.9% opposed).

Conclusion and Recommendation

The overall results reveal that the students' exposure and acceptance is considerably average. Therefore, it is sufficient to conclude that all groups of respondents have the same thought over all the factors, thus evident the strong confident over the motion that CS students have a good perception and confident on OSS.

Fakulti Sains Komputer & Matematik also can develop an Open Source Software Community Club within the faculty to attract the students to get involved in lots of activities such as OSS games, series of seminars, talks, colloquiums and hacking competition. This mainly can give a starting point to adopt and increase the Open Source software awareness among the Computer Science students as a whole.

Besides that, the lecturer can also contribute to the acceptance of OSS by giving extra credits to the students that perform their assignments or group projects by using Open Source software such as Linux GCC, OpenOffice, PHP_MySQL and FreeBSD. Further to the above, the lecturer can also provide opportunities to the students to choose their own favorites operating systems besides Windows in the lab session especially on subject of Operating Systems, Computer Problem Solving and Computer Security as other alternative OS that they can use.

According to Keith and Jennifer (2003), OSS can serve as a channel, method, and technology to teach and learn Computer Science. As a channel, OSS can expand teamwork past the classroom to include much larger projects and more distributed teams. As a method, OSS can be used to introduce our students to the larger computer science community and to the practice of peer- review. Finally, acting as a technology, OSS can provide us with free or lower-cost technology in the classroom that we might otherwise be unable to afford.

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