Jurnal Teknologi

Full paper

Measuring Student Satisfaction Towards iPVD

Norliza Abd. Rahmani[a,b*], Siti Rozaimah Sheikh Abdullah[a,b], Faezah Esa[a], Nazlena Muhamad Ali[c]

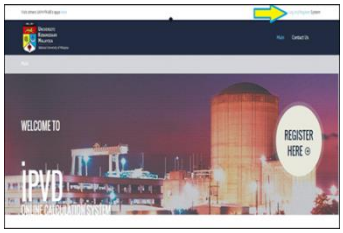
[a]*Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Selangor, Malaysia*
[b]*Centre of Engineering Education Research, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Selangor, Malaysia*
[c]*Institute of Visual and Informatic , Universiti Kebangsaan Malaysia, Selangor, Malaysia*

*Corresponding authors: liza@ukm.edu.my

Article history

Received : 7 January 2015
Received in revised form :
7 March 2015
Accepted : 8 April 2015

Graphical abstract



Abstract

This paper examines student satisfaction towards iPVD software. Students were given a brief introduction on this software and required to access online. The URL for iPVD during testing period is http://103.18.247.37/vessel. A survey form was designed by focusing on a variety of iPVD aspects and compared with ASME Manual Code. Results obtained from this survey analysis help us to improve the performance and quality of iPVD software. It was found that students prefer to use iPVD software for calculation with huge data that require accuracy. However, knowledge in basic of calculation such as ASME Manual Code is necessary in using this software.

Keywords: iPVD; Likert scale; mechanical design

Abstrak

Perisian interaktif yang dikenali juga sebagai iPVD merupakan perisian interaktif yang direkacipta berdasarkan buku manual kod ASME bagi membuat pengiraan ketebalan bekas tekanan. Kaedah pengiraan menjadi lebih mudah dan menjimatkan masa pelajar jika dibandingkan pengiraan secara manual. Kaedah yang diperkenalkan ini dapat meningkatkan pemahaman dan keberkesanan untuk tujuan pendidikan kerana sesuai untuk peringkat pelajar secara khususnya dan industri secara amnya. Rekaan perisian iPVD yang dibina berkonsepkan interaktif dan inovatif selaras dengan peredaran dunia teknologi masa kini yang mudah, cepat dan selamat untuk beroperasi. Pelajar melayari URL http://103.18.247.37/vessel bagi menguji aplikasi iPVD.

Kata kunci: iPVD; skala Likert; rekabentuk mekanik

1.0 INTRODUCTION

An interactive software known as iPVD was designed based on ASME Manual Code to compute the thickness of pressure vessel. This software offers easy calculation methods that will save students time compared to manual calculation. Moreover, this method can improve understanding and effectiveness of calculation for educational purposes as it appropriate for students' level in particular and for industry level in general. The interactive and innovative iPVD software was built in line with today's technology which is fast, simple and safe.

Interactive short cut method for designing pressure vessel was developed for upgrading the present programming from 5 files (Visual Basic) to single file. Both systems have a same calculation but this iPVD method is more interactive and innovative. Figure 1 showed interface of calculation online system which including symbol UKM, menu, contact us, log-in and register here. Symbol 'arrow' indicate that the user have to log-in by entering username and password.

The procedure to calculate the minimum thickness value of t_{min} typically based on ASME code. All calculations in the procedure are done manually which is involved complicated formulas and too many graphs, the designer may make a mistake in calculating or taking data from a graph[1,2]. Before designing pressure vessel, the designer must know if it in internal pressure or external pressure[3,4] based on the operating pressure of the vessel to ensure the safety of vessel under the certain pressure. Both pressures have their own procedure in order to find the minimum thickness value of t_{min}. So, the problem exists when the students usually take a wrong procedure of both pressures. Finally, the calculation of t_{min} value is wrong.

ASME Mission is to serve global communities by advancing, disseminating, and applying engineering knowledge for improving the quality of life and communicating the excitement of engineering. There is no international standard is used to design a pressure vessel, but the most widely used codes are American Society of Mechanical Engineers Code (ASME) codes [4], British Standard, Boiler and Pressure Containers used in the United States, Canada and other countries. There are a total of twelve sections contained in the ASME code. For most of the former chemical plant and refinery, it is contained in section VIII. There are 3 sub-section in section VIII :

- Division 1 provides requirement applicable to the design, fabrication, inspection, testing and certification of pressure vessels operating at either internal or external pressures exceeding 15 psig. It

containing general rule and usually followed to former low pressured

- Division 2 requirements on materials, designing temperature, and non-destructive examination are more rigorous that in Division 1. However, higher design stress intensify values are permitted. Usually, this division are using at highly pressure design to save cost.
- Division 3 requirements are applicable to pressure vessels operating at either internal or external pressures generally above 10000 psig.

Section VIII of ASME code explained the way on how to designing pressure vessel. Pressure vessels that operate on the internal and external pressure can be designed in accordance with the ASME code. Besides, the summary and graphs also included in order to facilitate designer to refer back during designing.

The validation of the iPVD with the industrial values was taken place at the Asturi Metal Builders (M) Sdn Bhd, Gebeng, Kuantan, Pahang on 28 August 2014. The objective for this visit is for validation from industrial which has used ASME code similar with the iPVD, besides to evaluate the application that can support engineers for Pressure Vessel Designing. The results from industrial values showed that there are different values between this system and industrial systems. Some of the term or values that use by industrial does not interrelated with this systems application. The Asturi Metals Builders said that iPVD is suitable for educational purpose because it is user friendly, portable, easy and understanding. Collaboration with industries gives a high impact to market this system for a future.

The objective of this study is to measure student satisfaction based on the survey form from preliminary iPVD tests.

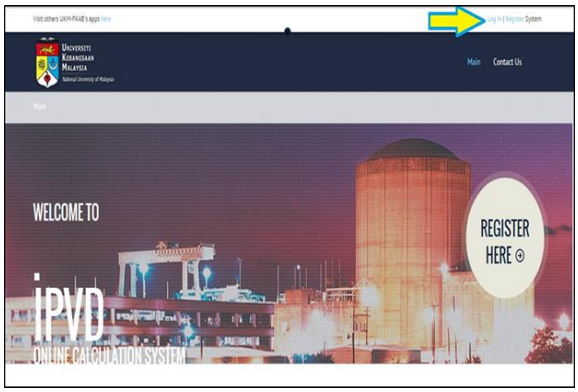


Figure 1 GUI of iPVD (Online calculation system)

1.1 iPVD Test

There are 15 steps including summary of calculation by simply entering the values needed by the design, the result will be calculated by the system, as shown in Figure 2. This system is embedded with all equations, graphs, figures, and calculations.

This method is part of extend the programming algorithm until calculation of maximum allowable weight Pressure, MAWP is obtained.

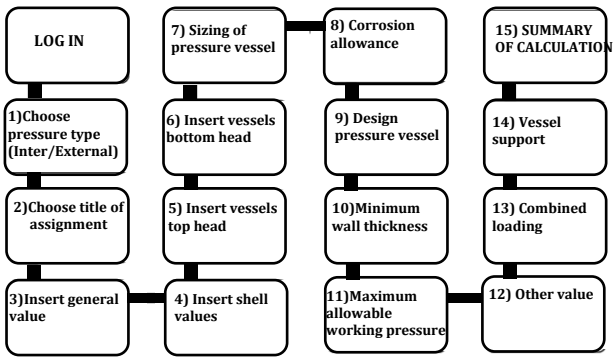


Figure 2 Steps calculation of iPVD

2.0 MATERIALS AND METHOD

2.1 Assessment

15 respondents were chosen among third year students of Chemical and Process Engineering course. The assessments were carried out at a Design Laboratory.The URL for iPVD during testing period is http://103.18.247.37/vessel. An introductory of iPVD software [5] was delivered in advance by an expert and respective students were required to register online for the assessment. At the end of iPVD session, a survey form was delivered manually to each student. The questionnaire was created into four parts that are Demography, Usability of iPVD software, Comparison of iPVD and ASME Manual Code and Conclusion.

This section is intended to look for respondent's preference between interactive software iPVD, ASME Manual Code or no difference in term of their effectiveness of calculation offered. This part covers 12 questions and results obtained were analyzed in percentage.

In Demography part, respondents were asked for their gender, age, highest education, and ambition. For Usability part, the questionnaire was created based on 5-point Likert scale measuring instrument (Table 1). Students were asked to mark in the interval scales to reflect their perception on the questionnaire. Perception refers to student attitudes towards actual performance delivered. IBM SPSS Statistics 12 was used to measure the percentage of response received.

Table 1 5-Point Likert scale of measuring instrument

LIKERT SCALE	PERCEPTION
1	Most Disagree
2	Disagree
3	Not Sure
4	Agree
5	Most Agree

3.0 RESULTS AND DISCUSSION

Four male and eleven female students with the age range from 22 to 25 years old took part in this assessment. All of them hold a bachelor degree and be ambitious of being either an engineer or lecturer. Table 2 represent demographic data of students involved:

In Part 2, this section offers 11 questions regarding usability of iPVD software. Table 3 shows the data of student's perception toward the usability of iPVD software as the easier alternative to solve the complicated calculation.

*From the Table 3 and Table 4, the notation capital "N" represents the number of vote on student perception of each question.

Table 2 Demographic data of respondents

NO.			Quantity	Percentage (%)
1	**Gender**	Male	4	27
		Female	11	73
2	**Age**	<19	-	-
		20-22	10	67
		23-25	5	33
		>25	-	-
3	**Previous Education**	SPM	-	-
		Certificate	-	-
		Diploma	-	-
		Bachelor Degree	15	100
		Master Degree	-	-
		Doctor of Philosophy Degree	-	-
4	**Ambition**	Engineer	13	87
		Lecturer	2	13
		Management/ Administration	-	-
		Designer	-	-
		Authority	-	-
		Technician	-	-
		Others	-	-

Table 3 is the students' perception toward usability of iPVD software. Generally the question is about the usability of iPVD software in designing pressure vessel within student course. The interior design of software is asked on interactive user interface, the capability of student to using the software. The user-friendly of software is the main aspect for user to learn step by step. Lastly the question is about the effectiveness of iPVD to designing pressure vessel, the precise calculated value, complete and detail complicated calculation done easily without referring to manual handbook.

Table 4 is the comparison between iPVD software and ASME manual code. Student choose the between iPVD software, ASME manual code or there is no different between both on help student on designing pressure vessel. Which method is easily to understand and use. Most manageable process on designing pressure vessel to design pressure vessel is the important aspect to help student. Last part is the precision and accurate result from the complicated calculation. The compile data of responder is tabulated as in Table 4.

Table 3 Students Perception Towards iPVD Software

Question		1	2	3	4	5	6	7	8	9	10	11	TOTAL	%
Most Disagree	**N**	0	0	1	0	0	0	0	1	1	1	0	**4**	**2.4**
	%	-	-	6.7	-	-	-	-	6.7	6.7	6.7	-		
Disagree	**N**	1	0	0	2	0	0	1	2	3	3	0	**12**	**7.3**
	%	6.7	-	-	13.3	-	-	6.7	3.3	20.0	20.0	-		
Not sure	**N**	0	1	2	1	4	3	4	6	3	8	2	**34**	**20.6**
	%	-	6.7	13.3	6.7	26.7	20.0	26.7	40.0	20.0	53.3	3.3		
Agree	**N**	14	14	10	11	11	11	10	6	5	3	10	**105**	**63.6**
	%	93.3	93.3	66.7	73.3	73.3	73.3	66.7	40.0	33.3	20.0	66.7		
Most Agree	**N**	0	0	2	1	0	1	0	0	3	0	3	**10**	**6.1**
	%	-	-	13.3	6.7	-	6.7	-	-	20.0	-	20.0		
Total Responder		15	15	15	15	15	15	15	15	15	15	15	**165**	**100%**

Table 4 Comparison of iPVD and ASME Manual Code

Question No.		1	2	3	4	5	6	7	8	9	10	11	12	Total	%
IPVD	**N**	8	9	9	9	15	10	8	14	13	13	13	12	**133**	**73.9**
	%	53.3	60.0	60.0	60.0	100.0	66.7	53.3	93.3	86.7	86.7	86.7	80.0		
Manual Code	**N**	4	2	4	2	-	2	7	1	1	1	2	3	**29**	**16.1**
	%	26.7	13.3	26.7	13.3	-	13.3	46.7	6.7	6.7	6.7	13.3	20.0		
No Different	**N**	3	4	2	4	-	3	-	-	1	1	-	-	**18**	**10.0**
	%	20.0	26.7	13.3	26.7	-	20.0	-	-	6.7	6.7	-	-		
Total Responder		15	15	15	15	15	15	15	15	15	15	15	15	**180**	**100%**

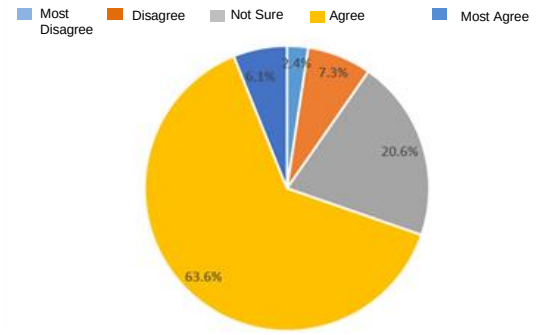


Figure 3 Usability of iPVD software

Based on Table 3 and Figure 3, we considered 63.6% of respondents agree with the usability of interactive software iPVD. This explains that iPVD is suitable for widely use appropriate for students level. Besides that, it offer simple calculation methods, easier performance of tasks division, comprehensive calculation module and give more precise answer compared to manual calculation. In contrast, only 2.4% responds with most disagree as they still need ASME manual code book as reference on calculating pressure vessel. Moreover, this interactive software does not have visual diagram of the type of vessel to help student understanding on the important selection of heads and skirt base ring. To sum up, feedback from students shows that interactive software iPVD is suitable for students in this course. The usability of iPVD software shows a great percentage to be applied in teaching and learning process in future.

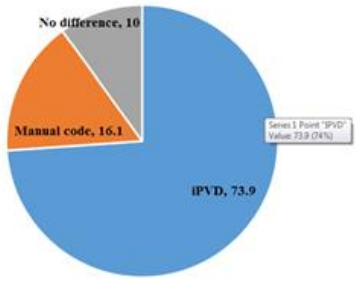


Figure 4 Student's preference of measurement methods

Figure 4 shows that 73.9% respondents agree with the selection of iPVD interactive software for a simple calculation method in learning process compared to ASME manual code book. In addition, iPVD is easy to bring anywhere, has simple learning tools and helpful in student's scientific project. Furthermore, it has potential to be used in the future because it able to enhance students' understanding of technology's compliance with the evolution of current technologies. Selection of ASME manual code book is 16.1%, because the students still need to refer on the manual book to shows the step method of design pressure vessel on design project. While selection of 'no difference' is about 10%, almost 18 students agreed that both these method are able to manage very well and also the precision result obtain from both method is not much different. This feedback shows that some students still require manual reference such as ASME manual to compute safer and more accurate pressure vessel when have more knowledge about formula and related graphs. No differences explain that students still get the same calculations

through iPVD software and ASME manual code. Therefore, design. Regarding to the feedback survey form of the student perception on iPVD software there are opportunity to improve the usability software by upgrade the visual diagram of the shell vessel and import/export the data to the others visual software such as Microsoft visio,autocad etc. Improvised the calculation step and show the diagram of graph from the ASME manual code to increase and encourage the student to use iPVD software.

The feedback from responder shows that students preferred to choose both in designing pressure vessel. Students satisfied with iPVD for learning subject, Table 5 shows the students' preferred aspects and not preferred aspects.

Table 5 Preferred and Not Preferred Aspects of iPVD

Preferred Aspects	Not Preferred Aspects
Faster and easier for calculation	Problem with server down
Attractive user interface	Require strong internet connection
Step by step calculation	Only applicable with browser "Mozilla"
Portable software	Less optional unit conversion
Not require manual handbook	Not require for manual solutions
Attractive method for calculation	Lacking of calculation method
	Lacking of basic fundamental of manual code handbook
	Require to insert the value "maximum allowable" manually

Students preferred to choose iPVD because of the attractive and simple method of design pressure vessel. In addition the user friendly of this iPVD interface encourage student to easily to learn step by step without refer to ASME manual handbook iPVD software still need lots to be improve based on students feedback. This the proposal in way to improving the system of iPVD to looks more interactive and innovative.

1. The calculated value must be fixed and cannot be change by user.
2. More optional on type of material or steel both methods help students for calculation in pressure vessel
3. Add workspace for MAWP calculation instead of insert manually.
4. Show the negative (-) value and notation of error value.
5. Improve the calculation summary by shows the calculation steps and the design of pressure vessel are logic, feasible etc.
6. Add glossary list box for help user understanding of skirt, internal fittings etc.
7. Add information box for general information.
8. Visualize the vessel after finish design pressure vessel in summary.
9. Add drop down menu button to select the type of material choose.

4.0 CONCLUSIONS

Generally, students choose to use iPVD software for calculation with enormous data that needs accuracy. However, students should know the basic of calculation in advance by referring to ASME manual code book for example. Furthermore, the effectiveness of iPVD interactive software should be studied in depth including enhancement from time to time despite receiving positive feedback from students and industry during the testing session. Hence, iPVD can be used in the future and potentially penetrate foreign markets.

Acknowledgment

The authors thank Universiti Kebangsaan Malaysia (Inovasi-2013-011) and the Asturi for supporting this research project.

References

[1] Sinnot, R & Towler, G. 2009. *Chemical Engineering Design.* Edisi ke-5. Massachussetts: Elsevier Ltd.
[2] Norliza Abd. Rahman, Siti Rozaimah Sheikh Abdullah & Johan Haris. 2014.
[3] Pembangunan Modul Interaktif bagi Prosedur Rekabentuk Mekanik Proses. Kongres P & P UKM 2013/2014.
[4] Azrul R. A. R. 2008. Software–Perisian http://ilplabuan.gov.my/download/080425%20artikel%20software%20-%20azrul.pdf [3 Oktober 2010] ASME Code 2012.
[5] Copyright iPVD, starting 1/5/2014. UKM3.2.29/108/2/916.