

An Instructional Approach for Product Features and Customer Preference Identification Using Product Reviews

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Abstract: Product design is a rapidly growing area that utilizes various technology and innovation to meet customer needs. In design, identifying customer needs is the first step toward designing a successful product. The conventional methods of obtaining customer needs are through surveys, questionnaires, and interviews. However, in the era of rapid development of the internet, consumer nowadays have a tendency to share their product experiences online. Thus, in the design perspective, online product reviews are one of the valuable sources to obtain user requirements. This study proposes the development of an instructional kit for product features and customer preference identification using product review documents. An instructional kit was developed to obtain user preferences using ADDIE development method. Three laptop brands were chosen and a total of 60 product reviews documents were retrieved from the two selected websites. The collection of data scores was analyzed using statistical approach to identify correct tag set. For evaluation of instructional kit, ten respondents with non-engineering background were involved to examine the effectiveness of the approach. The performance grades were determined using four achievement levels, with excellent score of 67 marks and above and passing score of 43 marks. The result shows that nine out of ten respondents were categorized under excellent score. The findings of this study indicated the suitability and applicability of the instructional kit for analyzing user preferences using online reviews.

Keywords: instructional kit, customer preference, product feature, review analysis, tagging

1. Introduction

Product design is a multi-disciplinary discipline that covers a wide range of concepts and values that provide the necessary function to offer sufficient business and engineering return. Design process usually involves technological innovations in response to market needs and in order to stay abreast of the changing technology. Design aspects greatly influence the quality of a product. Thus, the most important element in the production of quality products is motivated by customer need. User requirements are referred to as the needs to be resolved with regard to particular goods or services purchased. There are various methods to survey and to incorporate comprehensive customer requirement and preferences into design (Loh, Sun, Wang, & Lu, 2009) By using the conventional methods such as interviews, questionnaires, rebates, satisfaction surveys, target groups, phone surveys, etc. which are less efficient compared to modern techniques such as email and online product reviews. Currently, online product reviews become the medium obtain effective consumer needs which is fast, efficient and more relevant instrument to determination of the concept design (Ulrich, 2011). Industrial design engineers may use product review as an appropriate method to identify product design and user requirements for integration of the new ideas and innovations in the manufacturing field. However, analyzing these product reviews for customer preferences that are associated with certain product features presents significant research

challenges for the benefit of design engineers (Popescu & Etzioni, 2005).

In the area of engineering design education, comprehending the design problem in product design education is a critical stage especially for novice engineers in giving them necessary first insight during the design process (González, Quesada, & Bahill, 2003). The understanding of comprehensive consumer preferences and product design is a main part for product development. However, such an aspect is not emphasized due to the lack of good instructional media, especially in light of the amount of reviews generated online. Therefore, this study is aimed at producing an instructional kit product using product reviews, in an attempt to fulfill the gap in assisting students' understanding of the customer product preference and to evaluate the kit's suitability as learning material for the product design students .

2. Related works

2.1 Identifying Voice of Customer (VOC) and Product Design

In general, the process to achieve good products starts with identifying consumer needs, analyze and interpret the basic requirements of the requirements of product design needs effectively. Characteristics known as the representative of the customer or user (VOC) can be obtained in non-technical language and form. An effective strategy to assist in identifying VOCs for

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producing quality product is important (Liao, Chen, & Tseng, 2009). Nowadays, consumers are more likely to share their experiences, needs and design concern of a product through on-line services through the portals, personal websites, blogs and online forum specific. Product reviews utilized in analyzing online designer perspective by discussing new products and technical characteristics of a product (Zhuang, Jing, & Zhu, 2006). Product reviews can also be a source for a consumer to make a decision before they purchase a product (Hu & Liu, 1998). These product reviews are also very useful for designers to obtain more efficient feedback on their products and make changes accordingly. In the design engineering community, there are several notable works on product review analysis. Opinion mining is one of them, aimed at understanding user feedback on user sentiments of product features in the review document (Pontiveros, 2012). In general, users can combine all the comments from several websites and can act upon the purchase (Lee, 2007)

Although generally review products online is very valuable as a useful resource, there are various research challenges. For instance, designers are unable to distinguish the authenticity of the reviews presented online. This is associated with fraud where duplicate review information are present, automatic commenting, etc (Ozkaynak & Ust, 2012). Besides that, other issues include the use of different language in writing, using custom vocabulary and terminology that may not reflect the actual product preferences. As a conclusion, product designers need to take appropriate steps in reviewing the usefulness of these review information so that the information presented will be useful for the design process.

2.2 Design Education Issue

Industrial design as being a multidisciplinary profession is influenced by new trends depending on new developments in different science fields. The emerging technology has led to significant alteration in the discipline of industrial design which has facilitated the access of the product closer to the end product with integrated techniques and the concept of design, but design education and more specifically design educator haven't been able to keep up with those transformations. As a result, the product engineer student continues to learn outdated method and technique (Yang, You, & Chen, 2005). Design field today face the critical aspect which is how to develop a new form of design education in teaching and learning process. Design educator must find a way to teach the students the skill of flexibility to combine of different types of knowledge. A designer need to understand the processes, method and medium of design to produce a great idea of product design.

In order to produce a high quality product, the characteristics of the design requirements of users is the first step that should be emphasized. The focus, engineering education faces a major challenge in identifying the needs of consumers by the lack of

teaching aids skills in solving design problems. Without proper understanding of the design process, design students have limited ways in understanding design problem. Problem-solving skills is important to gain new idea for designing product (Liang, Liu, & Loh, 2013) Thus, the design process takes some degree to address student knowledge for control design system which is design process and strategic approach in order to adapt to the technologies changes in product design

3.0 Methodology

This part is divided into two main phases. Chapter 3.1 describes data acquisition and process tagging aimed to analyze design needs of consumers from reviews while Chapter 3.2 illustrates the development of instructional kit for use in the teaching and learning process show the operational framework has been developed.

3.1 Dataset Preparation & Analysis

This study has conducted experiments on the customer review of three laptop brands which is Asus, Lenovo, and Samsung. A total of 60 online product reviews has been collected from two websites: *notebookreview.com* and *laptopmag.com*. For tagging purpose, these reviews are divided into 10 product sets. Each set consists 6 different documents of product three different laptop brands. During the tagging process, each tagger is given two different sets of product reviews that contain 12 sets of documents product reviews. Besides, data analysis phase of each tag (product features and description) was identified and analyzed using Microsoft Excel to obtain common tags between three taggers. Analysis and verification of tagger consistency of common tags were executed using Equation (1) as below:

Table 1 : Sample data

BRANDS WEBSITES	ASUS	LENOVO	SAMSUNG
<i>www.notebookreview.com</i>	20	20	20
<i>www.laptopmag.com</i>	20	20	20

$$tagger\ accuracy = \frac{correctly\ tag\ identified}{Total\ tag\ identified} \times 100\ \% \quad (1)$$

Figure 1 gives an overview of steps involved in the tagging process and identification and verification of the correct tagset through online product reviews. Firstly, a total of 15 voluntary students, with product design knowledge, were gathered to discover tags in 60 selected reviews. Each documents were at least tagged by two taggers and common tags among these taggers were identified as correct tagset scheme. The correct tagset are then further verified by subject matter experts either the tags identified were acceptable or not. Based correct tagset, the instructional kit was developed. Evaluation of instructional kit will be carried out using user study where a group of inexperienced users will study the kit. Their performance will then be evaluated using tag verification and achievements.

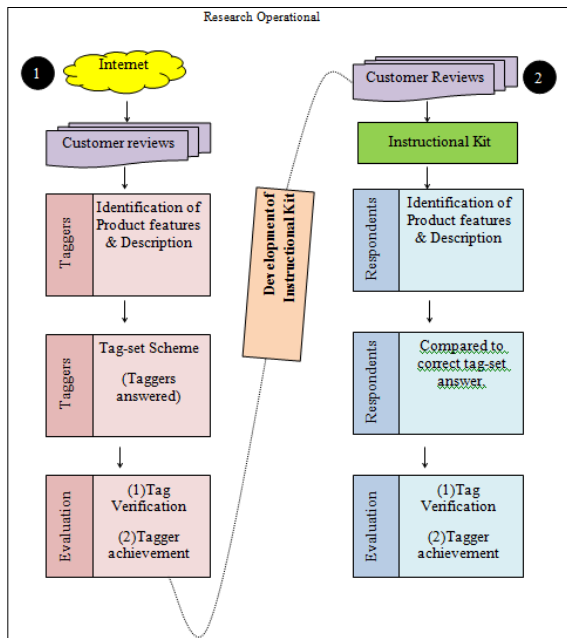


Fig. 1 : Tagging Process

3.2 Development of Instructional Kit

The development of this instructional was based on the ADDIE development model. ADDIE stands for Analysis, Design, Development, Implementation and Evaluation that represents the important phases in developing a good instructional kit. Figure 2 shows in summary the process involved in developing the instructional kit.

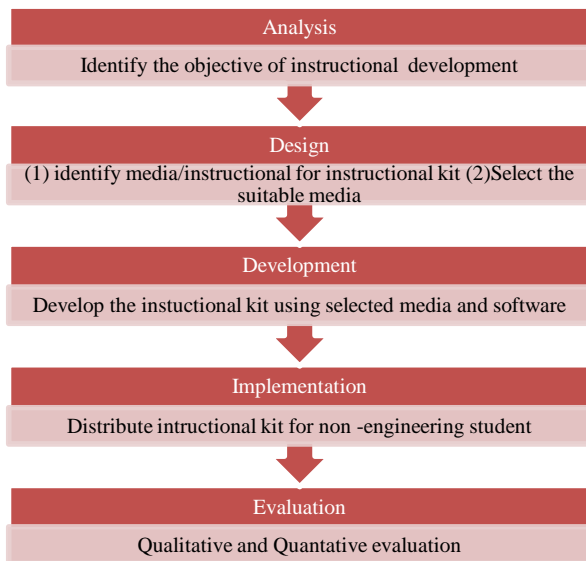


Fig. 2 : Development of kit instructional using ADDIE model.

In the analysis phase, the objectives of this instructional kit were identified to achieve the primary goal of this study. The objectives of this development of instructional kit are as follows: Firstly, as a guide for any interested

parties (e.g., instructors, students and lecturers) to identify of the product features and user requirements using product review; and secondly, as a teaching and learning aid to evaluate the student's skill level in analyzing reviews for customer needs. The design phase contains two parts, an introduction and detailed instructions for analyzing the characteristics of the product in online product reviews. The third phase involves the development of instructional kit in booklet form that is easy to refer. The fourth phase is the implementation steps which involves user study. After the instructional kit is complete, a user study was conducted where the instructional kit together with the questionnaire and product reviews were distributed to ten randomly-picked respondents, who not possess any knowledge about product design to try out and to give their feedback. The final phase was evaluation where summative assessment was conducted. For performance rating, researchers used scores from previous tagging exercise in phase I as criteria for evaluating student achievements. Thus, norms grading are used as variables. Assuming users' scores are normally distributed, a student's performance can be determined using the concept of the normal distribution and z-score as in Equation (2) below.

$$z = \frac{\chi - \bar{\chi}}{\sigma} \quad (2)$$

4.0 Result

4.1 Tagging Result

A total of 15 students of mechanical engineering background have been selected as taggers in this study. Overall tagging process took about 3 hours to complete. Each tagger is required to identify and circle any words or phrases that indicate product features and underline any word that could be considered as the product description. The following shows an example of the aforementioned tagging process:

“We run Powermark while balanced battery life mode”

Tagger id	filename	Type	content
Tagger 08	01-notebook review-asus-zenbook	features	laptop /tablet/notebook
		processor	CORE i7 quad-core
		ram	open slot
		descriptions	thin and light
			expensive
			respectable
			fastest mobile
			upgradability
			accessibility
			650 M with 2GB
Tagger 03	01-notebook review-asus-zenbook	features	laptop /tablet/notebook
		processor	Core i7
		ram	open slot
		Description	thin and light
			high end features
			15.6 inch
			unique
			lack internal optical drive
			well rounded
			15.6 inch

Fig. 3 Data Classification

All the words tagged on the reviews was classified and sorted to reveal common set of tags on products features and product descriptions. A tag is considered common when two-third of taggers agreed on the same tag for a document. The common tag set will serve as the

correct tagset when it was verified by content experts. Content experts consist of those who are experienced in product design and are teaching design courses for Industrial Engineering programme. The verification of correct tagset was successfully done where all content experts agreed that the common tagset was suited as product features. Figure 3 below shows an example of the classification of the product features to obtain correct tagset.

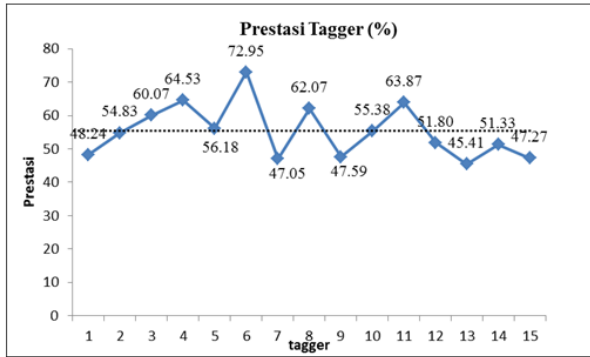


Fig. 4: Tagger achievement

After that, the taggers' performance can be determined using Equation (1). Figure 4 above shows a summary of the taggers' performance. The horizontal axis of this graph indicates taggers while scores obtained appear on the vertical axis. Out of 100, the average tagger score of the whole document for all taggers is 55.23. There six taggers that have achieved scores beyond the average value (average line). The highest score is 73 (t_6) as best tagger performance and the lowest score is 45.51 tagger 12 (t_{13}). The average scores for the six taggers that exceed the average score line is 63.15 while the average score for the rest of the taggers are 49.18, below the average score line.

4.2 Instructional Kit

The development process for Instructional kit is included designing the cover page for instructional kit, color selection, theme and style that is appropriate for all user ratings. The instructional kit contains 5 printed pages. The instructional kit contains all essential information for the user, including product description, definition, and steps on how to identify product features and description from review documents. This kit includes a description of the product features, product descriptions and step-by-step procedures for user use. The instructional kit developed is aimed at assisting students in understanding of contents of customer needs on product features. Figure 5 shows a sample screenshot of the developed instructional kit.

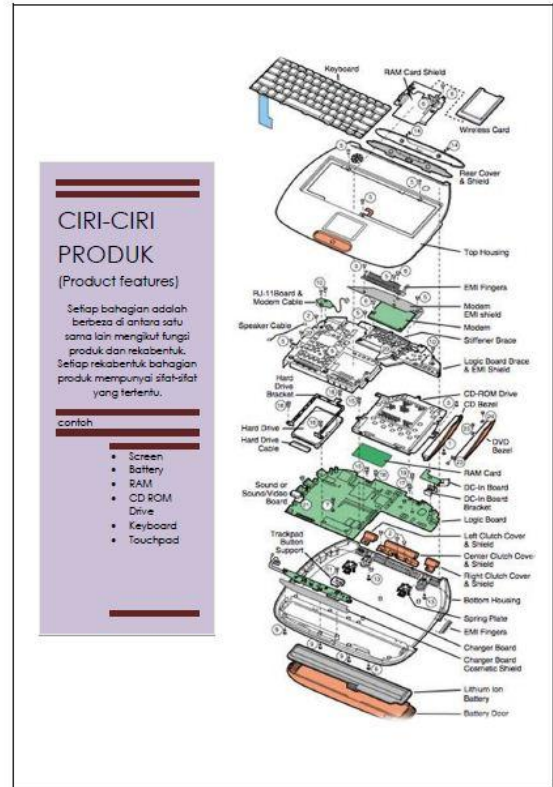


Fig. 5 Instructional Kit

4.3 Evaluation of Instructional Kit

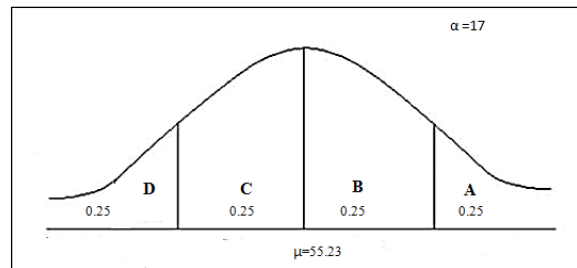


Fig. 6 : Tagger achievement

By assuming that performance data is normally distributed, score obtained in each grade are calculated to determine a passing score per consistency data. The distribution of 180 reviews of online products produced mean of 55.23 and standard deviation, σ of 17. Each area is divided into 4 sections where each section is determined using $\alpha = 0.25$ as shown in Figure 6.

Score (%)	Achievement	Grade
67 and above	Excellent	A
55-66	Good	B
44-54	Pass	C
43 and below	Fail	D

Table 2: Tagger Grade

In the evaluation process, each respondent was given a randomly selected product reviews for tagging performance evaluation after they have studied the instructional kit. Their tags are then compared with the correct tagset for evaluation. Figure 7 shows their overall achievements. From the figure, horizontal axis of this graph shows the ten respondents and the vertical axis indicates the percentage of respondent's achievement. In overall, respondents' score are positive. The best respondent that able to gained highest score is respondent r_6 with 95 marks which is to reach a peak. The lowest performer is respondent r_8 with 61 marks. The score difference between r_6 and r_8 is 34%. The average score obtained for ten respondent are 78%. In overall, 80% of respondents achieve grade A (excellent) while the rest obtained grade B.

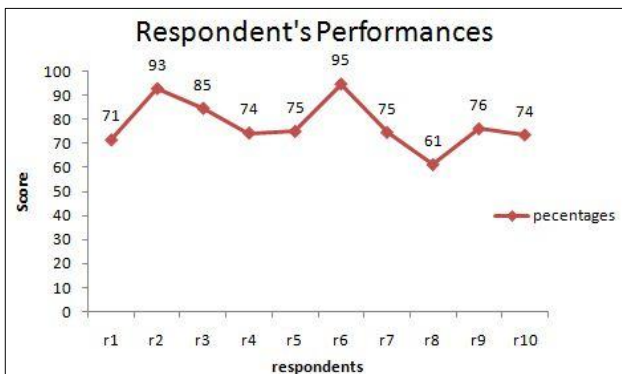


Fig. 7: Overall respondent achievement

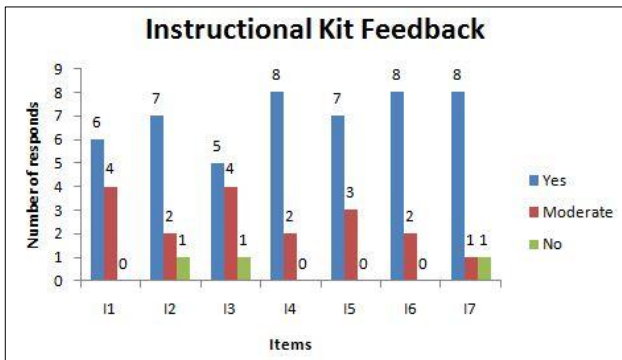


Fig.8 : Item analysis

Besides grading on tagging performance, respondents were also given options on their perception towards various aspects of the instructional kit presented to them. Their responses are as summarized in Figure 8. From Figure 8, the graph shows a difference where 10 respondents are in agreement towards various aspects of the instructional kit. Overall, respondents have had positive experience regarding the usage of instructional kit. Majority of the respondents agreed that the content was comprehensive (80%) and easy to understand (70%). Most of them also agreed on the suitability of graphical presentation (80%). The items related with the interactivity were presented in item six in the questionnaire. Items of the highest mean score (mean

score = 8) were items that were familiar with the usage of instructional kits. In summary, 80% of respondents think that the instructional kit had assist them to identify the product features and product description that met customer need through online product review.

In the open ended part, respondents were asked about their opinions towards the kit. Most of them think that the kit can be distributed to students as an alternative learning material or learning tool in product design. Their feedback showed that most of them were satisfied with the kit presented to them, but improvements are still needed in terms of content presentation. The results also revealed that most of the respondents would recommend the usage of this kit as a user manual for design engineers.

4.3 Conclusion

This study proposed the development of an instructional kit for product features and customer preference identification using product review documents. An instructional kit was developed to obtain user preferences using ADDIE development method. The results from the study have been promising. The students' performance towards instructional kit produced was good in the overall sense. Findings revealed that items related to instructional produced positive feedback. The average tagger score is 55.75% for the dataset preparation stage. Based on the identified correct tagset, a user study was conducted to test the effectiveness of the instructional kit. The results shows that the instructional kit can be very useful towards inexperience, first time users. For future work, we intend to further improve the instructional kit in terms of content and graphical presentation, e.g. by making it more interactive and intuitive for the benefits of design community.

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