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MESSAGE FROM
Assoc. Prof. Zainorin Mohamad
The Chief Editor of Marine Frontier

2014 has been a truly challenging year for Marine Frontier. Faculty members had to cope with the demands for introducing new teaching methods, engagement with industry partners and soliciting of new external research grants whilst contributing to produce higher quality papers for publication. Despite these challenges, it is my pleasure to welcome readers to the Marine Frontier's 1st Issue of 2014.

In this issue, the papers published cover studies in the areas of marine waste management, propeller production methods, marine application materials, electronic devices development, quality management practices, etc. Featured are also studies in areas of teaching and learning covering topics on website quality, spoken English and Mandarin oral test. I hope the papers shared in this issue will be useful in enhancing future studies and the teaching and learning in marine engineering technology.

Promoting the culture of writing more research papers, the 1st Engineering Technology and Marine Applications (ETMA) Conference organized by UniKL MIMET was held on 20th - 21st October 2014 at Langkawi. Participation in other national and international level conferences and innovation competitions was also encouraged. As the year 2014 comes to the end, let's continue to improve the quality of research papers inspired by the significant achievements that we have made in research, innovation and industrial partnerships. Looking forward, we should encourage more joint research with local and international university partners and explore more applied based research with industry partners.

My heartiest gratitude goes to all the paper contributors, editors, editorial members and the technical support staff for making the publication of this issue possible. Thank you all!!
THE CONTRIBUTION OF 5S TOWARDS TOTAL QUALITY MANAGEMENT: A CASE STUDY IN MMHE, PASIR GUDANG, JOHOR

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Received 25 July 2013; Revised 28 August 2013; Accepted 28 August 2013

ABSTRACT
5’s practices play an important role either in daily life and work station. The 5’s is related to Total Quality Management. This good practice supports to provide a good structure and coordination of the workstation to be placed nicely and tidy and easy to be retrieved. There are several studies of 5s practices towards Total Quality Management and several industries have practices 5s in their workstation. The aim of this research is to determine the awareness of 5S practices, to analyze the effectiveness of 5S practices and to identify the efficiency of 5S towards Total Quality Management in MMHE, Pasir Gudang, Johor. A set of questionnaire has been constructed by using Likert-Scale and has been distributed to employees ranging from Upper Management to Lower Management. A sample of 69 respondents from one marine company comprises individual from top management, middle management and first line management provided data for this research. From the results, it shows that, there is a very strong relationship between awareness of 5S practices and efficiency towards TQM at 0.518 and also a very strong relationship between the effectiveness of 5S practices and efficiency towards TQM at 0.500.

Keywords: 5’S, Total Quality Management (TQM), Awareness, Effectiveness and Efficiency

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INTRODUCTION

There is a direct impact on company resulted from the improvement of the management practices. The 5S technique has been used to maintain and establish the organization with a better quality environment. The Japanese practitioner believes that 5S is very useful to improve the physical environment and also to upgrade the thinking method (Ho, 2007). 5S is known as one of the basic elements in TQM. The relationship of these two systems is solid and connected to each other. TQM consists of several elements such as Benchmarking, Lean Manufacturing, Continuous Improvement, Quality Management and ISO Certification. It is more concerned on the high quality of the management practices, product or service provides to the customers.

The objectives of this research are to determine the awareness of 5S practices, to analyze the effectiveness of 5S practices and to identify the efficiency of 5S practices towards TQM. The outcome of this research is used to improve the work station and site projects. It is also used to ensure all tools and equipment are placed correctly. Furthermore, it helps to enhance awareness among employees and to improve the implementation of 5S towards TQM and assists the organization to become the great company and achieved the target and being well managed. This research was conducted in MMHE, Pasir Gudang, Johor Bharu maritime industrial area in the ship building department, repair and service department, warehouse department and management department.

5S Definition

Stewart Anderson (2005), there are five concepts in 5S practices; Setting, Shinning, Standardizing and Sustaining. Sorting in any working place must be accumulates all the junk. It also teaches to identify the type of items and get rid of them at a specific place. Setting means to organize all the order in an organization. Without a proper setting, it will get messed up.

Shining is used to estimate by cleaning work or clean at work station. It involves maintenance, cleaning machinery, equipment and tools. Standardizing means setting up routine and precise time of order and maintenance. After taking a break at every shift during work or after, employees must set up a clean task in the same sequence. Sustaining focuses on the discipline and it is the main cause of success in any industry. Usually the responsibility for the discipline of the employees currently is managed by the team leaders. It is also a driven support of the auditing system that’s being used to measure the conformance.
Table 1: Characteristic of Respondents

<table>
<thead>
<tr>
<th>SEGMENT</th>
<th>CATEGORIES</th>
<th>FREQUENCY</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>57</td>
<td>82.6</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>12</td>
<td>17.4</td>
</tr>
<tr>
<td>Age</td>
<td>20 - 29</td>
<td>29</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>30 - 39</td>
<td>15</td>
<td>21.8</td>
</tr>
<tr>
<td></td>
<td>40 - 49</td>
<td>12</td>
<td>17.4</td>
</tr>
<tr>
<td></td>
<td>50 - 59</td>
<td>7</td>
<td>10.1</td>
</tr>
<tr>
<td></td>
<td>60 and Above</td>
<td>6</td>
<td>8.7</td>
</tr>
<tr>
<td>Educational Background</td>
<td>PhD</td>
<td>2</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Master</td>
<td>3</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>Bachelor</td>
<td>7</td>
<td>10.2</td>
</tr>
<tr>
<td></td>
<td>Diploma</td>
<td>23</td>
<td>33.4</td>
</tr>
<tr>
<td></td>
<td>SPM, STPM</td>
<td>24</td>
<td>34.8</td>
</tr>
<tr>
<td></td>
<td>Other Certificate</td>
<td>10</td>
<td>14.4</td>
</tr>
<tr>
<td>Job Position</td>
<td>Top Management</td>
<td>5</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td>Middle Management</td>
<td>7</td>
<td>10.2</td>
</tr>
<tr>
<td></td>
<td>First Line Management</td>
<td>57</td>
<td>82.6</td>
</tr>
<tr>
<td></td>
<td>Supervisor, Executive, Others</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Correlations Analysis

Table 2 shows the interpreted results of correlations relations between Independent Variables and Dependent Variable.

Table 2: Interpretation Strengths of Correlations Using Pearson’s Correlation

<table>
<thead>
<tr>
<th>r value =</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0.70 or higher</td>
<td>Very Strong Positive Relationship</td>
</tr>
<tr>
<td>+ 0.40 to + 0.69</td>
<td>Strong Positive Relationship</td>
</tr>
<tr>
<td>+ 0.30 to + 0.39</td>
<td>Moderate Positive Relationship</td>
</tr>
<tr>
<td>+ 0.20 to + 0.29</td>
<td>Weak Positive relationship</td>
</tr>
<tr>
<td>+ 0.10 to + 0.19</td>
<td>No or Negligible Relationship</td>
</tr>
<tr>
<td>0</td>
<td>No relationship</td>
</tr>
<tr>
<td>-0.10 to -0.19</td>
<td>No or Negligible Relationship</td>
</tr>
<tr>
<td>-0.20 to -0.29</td>
<td>Weak Negative Relationship</td>
</tr>
<tr>
<td>-0.30 to -0.39</td>
<td>Moderate Negative Relationship</td>
</tr>
<tr>
<td>-0.40 to -0.69</td>
<td>Strong Negative Relationship</td>
</tr>
<tr>
<td>-0.70 or higher</td>
<td>Very Strong Negative Relationship</td>
</tr>
</tbody>
</table>
Table 3 shows the relationship of the independent variables on awareness of 5S practices and dependent variables on the efficiency of 5S towards TQM. It is shown that, the relationship is a Strong Positive Relationship \(^{[10]}\).

<table>
<thead>
<tr>
<th>Awareness_5s</th>
<th>Efficiency_TQM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.518**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>69</td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.518**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>69</td>
</tr>
</tbody>
</table>

Table 4 shows the relationship of the dependent variable on the effectiveness of 5S and dependent variable of efficiency of 5S towards TQM. It is shown that, the relationship is a Strong Positive Relationship \(^{[1]}\). Based on both correlations the variables are very strongly attracted to each other. It shows that most of the respondents are aware of the 5S practices, effectiveness of 5S practices of the company.

<table>
<thead>
<tr>
<th>Effectiveness_5s</th>
<th>Efficiency_TQM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.500**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>69</td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.500**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>69</td>
</tr>
</tbody>
</table>
TQM Definition and Philosophy

TQM philosophy covers all concept of continuous improvement in any organization and industry. It focuses on the systematic, integrated, consistent, organization-wide perceptive including workers and other things. TQM is primarily focuses on total satisfaction for internal and external of the customers within a managed environment with continuous improvement in all systems and processes. Besterfield (1995), defined TQM as both philosophy and set of guiding principles that represents the foundation of a continuously improving organization. It integrates a fundamental management technique, existing improvement effort and technical tools under a disciplined approach. Wilkinson and Wither (1990) defines TQM by Ho (1999):

Total : Every person is involved (its customers and suppliers)
Quality : Customer requirements are met exactly
Management : Senior Executives are fully committed

Berry (1991) and Yusof (1999), defined TQM process as a total corporate on meeting and exceeding customer’s expectation and significantly reducing costs resulting from poor quality adopting a new management system and corporate culture. Wolkins (1996), outlined TQM as a tool integrate fundamental management techniques, existing improvement efforts and technical tools under a disciplined approach focused on continuous improvement.

METHODOLOGY

This research uses the survey method to collect data at one point in time. A questionnaire was prepared based on measurements used by previous researchers. The set of questionnaire is used and has been distributed to employees in MMHE ranging from Upper Management to Lower Management. 10 pilot questionnaires have been distributed to UniKL MIMET staff at various levels in order to verify of the questionnaires understanding level and has deleted ambiguous and irrelevant and insignificant questions. The closed ended and upper ended questions were designed. 69 out of 90 questionnaires has been collected with 69.67% of the response rate. A face to face session was conducted especially among Lower Management employees. Meanwhile, the questionnaires have been distributed earlier among Upper Management.
FINDING AND DISCUSSION

Characteristic of Respondents

The respondents comprised of 25 respondents from Ship Building Construction, Maintenance and Repair Department, 23 respondents from Marine Fabrication Department and 21 respondents from other Department. Table 1 shows the characteristic of the respondents on gender, age, job position, educational qualification and durations of services in the company.

Male respondents were 82.6% and Female respondents were 17.4%. The numbers of Male respondents were 57 individuals and Female were 12 individuals. The Age of the respondents was 42% between 20-29 years old with 29 individuals, 21.8% between 30-39 years old with 15 individuals, and 17.4% between 40-49 years old with 12 individuals, age 10.1% between 50-59 years old with seven individuals and 8.7% 60 years old above with six individuals.

It shows that, the highest age of the respondents is aged between 20-29 years old and the lowest age is 60 years old above. The Educational Qualification PhD holders about 2.8% by two respondents, Master holders were 4.4% with three respondents, Bachelor holders 10.2% with seven respondents, Diploma holder were 33.4% with 23 respondents, STPM/SPM holders 34.8% and 24 respondents, certificate were 14.4% to 10 employees.

The SPM/STPM holder has the highest educational qualification among the respondents and the lowest education qualification is in PhD holder. For the Job Position, shows Top Management was the lowest respondents with five respondents, 7.2%, Middle Managements with seven respondents 10.2% and the highest respondents were from First Line Management such as Supervisor, Executive, and Others with 57 respondents 82.6%.
One Sample Test Analysis

This one sample test analysis is used to test on the Awareness of 5S practices in MMHE. Table 5 shows the $z$-value is 17.142 which is greater than the critical value of 1.65. Since the value of 17.142>1.65, thus the decision is to Reject the Null Hypothesis. There is enough evidence to support on the Awareness of 5S Practice in MMHE.

Table 5: One-Sample Test

<table>
<thead>
<tr>
<th>Test Value = 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$z$</td>
<td>df</td>
</tr>
<tr>
<td>Mean_Section C</td>
<td>17.142</td>
</tr>
</tbody>
</table>

The next sample test analysis is used to test on the Effectiveness of the 5S practices in MMHE. Table 6 shows the $z$-value is 14.717 which is greater than the critical value at 1.65. Since the value of 14.717>1.65, thus the decision is to Reject the Null Hypothesis. There is enough evidence to support on the Effectiveness of 5S Practices.

Table 6: One Sample Test

<table>
<thead>
<tr>
<th>Test Value = 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$z$</td>
<td>df</td>
</tr>
<tr>
<td>Mean_Section D</td>
<td>14.717</td>
</tr>
</tbody>
</table>
Finally, the sample test is also used to analyze on the efficiency of 5S towards TQM. Table 7 shows the $z$-value is 15.921 which indicates the critical value is greater than 1.65. Since $15.921 > 1.65$, thus the decision is to Reject the Null Hypothesis. There is strong evidence to support on the Efficiency of 5S towards Total Quality Management (TQM).

Table 7: One Sample test

<table>
<thead>
<tr>
<th>Test Value</th>
<th>df</th>
<th>Sig (1-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.921</td>
<td>68</td>
<td>.000</td>
</tr>
</tbody>
</table>

**CONCLUSION**

The conclusion of this research shows that, most of the MMHE employees are aware of the existing of 5S practices and understood it. The employees are aware that all unwanted items need to be removed from the working place and premise. The employees are also aware of the defect products which must be prevented from mix up together. Most of the employees are also aware that discipline is the main key to establish 5S practices. The effectiveness of 5S practices in MMHE shows that, the employees conduct and attend a regular meeting once a month to ensure the effectiveness of 5S practices among employees. All the employees contribute to the 5S regular training that has been provided by the company. All dangerous and hazardous places in MMHE have been labeled according to the 5S system.

The efficiency of 5S towards TQM shows that the customers are satisfied with product and service provided by the company. The direct continuous improvement has been made to defects, product or services supplied. The employees believe of the defect product is a waste to the company. The employees produce products based on quality because the company culture's is emphasis on the cleanliness and discipline towards the end product to be delivered to the customers. The company has given a suitable reward and recognition to employees based on the performance of 5S practices at work station.
RECOMMENDATIONS

The contribution of 5S towards Total Quality Management (TQM) is to ensure that the company must comply with the international standard practices. Firstly, the organization must create the awareness of 5S practices among employees, so that it will help the employees to work with clean and tidy work station. The company should also provide sufficient trainings or short courses on the awareness of good 5’S practices at different level of employees. By sending to a proper training session, employees will a have better understanding and will be equipped with knowledge about 5S system.

Besides that, the organization should also provide a field trip/ tour to the selected companies with 5S good practices such as Toyota. Secondly, in order to fulfill better significant result on the effectiveness of 5S practices, each of the employees should attend 5S meeting and apply best practice at work stations and among various departments. Thirdly, is to practice regular inspection by the leader at the workstation at least two times in one week or three times in a month. Fourthly, management should also provide a 5 S schedules to ensure each of the employees are accountable and responsible towards own work station. It is recommended that, the employees should work in a group task in order to complete the cleaning activities, especially in large areas such as warehouse, construction site and other project sites. Next recommendation is by supplying a score sheet on the effectiveness of 5s practices and will be judged by the 5S expertise as required. When the working place of work in order all the tasks can be done in a short period because all the material, tool and equipment easy to be fine.

On top of that, the continuous improvement teams need to update all employees, especially on how to fix the problems when is needed for any errors, defects and failures in productions or service processes. Finally, when the 5S system has achieved the goals, a company should acknowledge and praise employees by giving a recognition and reward system. This will encourage the fellow employees to successfully work together and a display systematic 5s practice, attitude and gradually will produce high quality work task and significantly strike for the mutual company goals and achievement.
REFERENCES


ABSTRACT
The marine industry is synonymous with ship construction and repairs. Ships are built to meet the demands of sea transportation for the imports and exports of a nation. As more ships come into the market, the question of the by-products of ship construction would naturally be given a thought. These by-products are usually referred to as marine industrial waste and they come in various forms, such as in the solid and liquid states that can pollute our environment if their disposal is not properly managed. These waste are actually the resources lost in the production process, and shall also be referred as production waste. This loss should be reduced to improve a company’s profit margin or bottom line. The amount of production waste in developed countries is much higher than in developing countries. However, waste management in the former is more systematic and environmental friendly. This situation is similar to a shipyard. The bigger a shipyard means the total amount of industrial waste produced would be higher. That is why a systematic and effective industrial waste management system must be available in shipyards. This research attempts to find out what kind of waste management system is used in the local shipyard industry and also to investigate the relationship between effective waste management implementation and the company’s bottom line. Quantitative survey method was used to collect data from selected respondents. Data collected was analyzed, interpretations and recommendations made that would help further improve on the shipyard’s business performance.

Keywords: Scheduled waste management; Health, Safety, and Environmental Department; Environmental Management System (EMS), ISO 14001:2004.
INTRODUCTION

To study how effective production waste can be managed in the marine industry, a local shipyard namely Boustead Naval Shipyards (BNS) Sdn Bhd, which is conveniently located in the Lumut District of Perak was chosen. A shipyard having poor management of its production waste may face problems in its business operations such as risking its work environment, having limited material storage space, incurring high cost on utilization of raw materials, deteriorating of its marine environment and creating a negative reputation among clients. To help counter these problems, the Malaysian government had established the Department of Environment (DOE) that is responsible to ensuring sustainable development while maintaining a clean, healthy, and safe environment for the people. Under the enforcement by DOE, BNS has implemented a Scheduled Waste Management system on its premise. In BNS, scheduled waste is categorized into five (5) types, namely solid waste, paint waste, oil waste, sludge, and e-waste. The shipyard’s Services Department and the Health, Safety, and Environmental Department are responsible in monitoring scheduled waste disposal. Some of the scheduled waste types are sold, while for other scheduled waste types a disposal fee is incurred.

LITERATURE REVIEW

Production waste management is about disposing, processing, controlling, recycling and reusing the solid, liquid and gaseous waste in a controlled ecological system to maintain a habitable environment (US National Library of Medicine, 2013). To help business grow and prevent pollution, implementation of the ISO 1400:2004 EMS greatly helps. Scheduled Waste Management on companies to determine types of scheduled waste produced has been in force (DOE, 2013), to prevent, eliminate, control pollution and improve the environment consistent with the purposes of the Environmental Quality Act 1974.

Further understanding was sought on ISO14001 to derive environmental and business benefits. Customers are seeking company’s compliance with ISO14001 as proof of the environmental credentials of an organization. Thus, seeking of company’s stand on this issue should shed light on how effective the shipyard is managing its production waste on its premise. Compliance would increase competitive position, reduction of customer audits, reduction in waste/energy usage, better internal communication, improve export possibilities and staff motivation that should ultimately help improve the shipyard’s overall credibility and bottom line.
PROBLEM STATEMENT

Shipyards having poor production waste disposal systems may face many problems in their business operations. Some of the most glaring problems are namely, shrinking of work space due to mounting scrap materials, increase in cost due to poor recycling of unused materials, environmental pollution into nearby waterways that affect the fishery sector, and last but not least, loss of customers due to bad production waste management reputation.

RESEARCH OBJECTIVES

An effective management of industrial production waste in a shipyard involving shipbuilding or ship repair works usually helps in ensuring a better bottom-line and improving sustainability in its business. To help determine how effective waste is managed we had focused on the following research objectives, namely;

a) To what extent BNS has implemented effective production waste management on its premise.

b) To what extent the production waste disposal system of BNS has affected its bottom line (profit margin).

RESEARCH QUESTIONS

In order to meet the research objectives it is appropriate that some relevant research questions are developed that may help throw light into this study to ensure relevant findings can be interpreted to address the problems. Some of the relevant questions that were given to the respondents are as follows;

a) Has BNS successfully managed its production waste disposal system in all its departments since been in operation in 2005 ?

b) What is the level of production waste disposal awareness among BNS’s staff ?

c) How has implementation of production waste management affected the level of environmental pollution in BNS ?

d) What is the effect of BNS’s production waste management system to its bottom line (profit margin) ?
METHODOLOGY

This research used two methods, namely survey (questionnaires) and interview sessions. The questionnaires and interview sessions were directed on the Safety and Security Department of Boustead Naval Shipyard. The questionnaires consisted of three (3) sections, namely General Information of Respondents, Waste Management Problems and Waste Management and Implementation. In this research, the main population was BNS, and the sampling was categorized into six (6) groups, namely Shipbuilding, Ship Repair, Electronic, Weapon, Administration and Safety & Security Department.

DATA ANALYSIS AND DISCUSSION

This research focused on six (6) main sections of BNS, namely Administration, Ship repair, Shipbuilding, Electrical, Weaponry and Safety & Security, with each section been given a uniform set of questionnaires targeted to cover a balanced breakdown of respondents by nature of gender, age, race, religion, qualification, years of working and work section. Response to questionnaires was at 61 percent. Cross tab data derived from general information of respondents indicated that majority of staff are male, between 21 to 30 years of age, of Malay origin, having a basic university degree, having stayed on between 1 to 5 years, are mostly from the administrative section, followed by electronic, weaponry, safety & security, shipbuilding and ship repair sections respectively.

The problems of managing waste at BNS are dependent on factors, namely environmental, cost of managing waste, customer satisfaction and profits. Data analyzed using the frequencies variable method indicated that the majority of respondents at BNS agreed that there is low on-the-ground pollution, low surrounding water pollution, minimal waste at workstations as well as clean level of air quality in shipyard premises. These indicators are reflective of the efforts in planning towards the implementation of the ISO 1400:2004 EMS at BNS that is designed to improve not only business performance but also environmental performance. Data on cost associated with waste problems revealed that BNS had reused or recycled scraps such as off-cuts, had incurred low cost in waste collection, had incurred low cost associated with pollution damage and had faced minimal lawsuits (fines) relating to the Department of Environment.
This augurs well with BNS’s positive effort in controlling cost of waste management. Customer satisfaction at BNS is related to the level of problems with regards to managing of its waste. Respondents who deal with customers were able to reveal a great deal of information regarding this aspect. Data on customer satisfaction levels indicated that the majority of BNS customers never complained about waste issues at BNS, never enquired about implementation of ISO14000:2004, ‘green’ companies are ever willing to do business with it while number of its customers have been on the increase since 2005.

![Percentage of Respondent that Answer the Questionnaire](image)

Figure 1: Pie chart of response by respondents

An important variable that influences the level of an organization’s waste management efforts is related to its profits. High profits would relate to good waste management efforts, hence less waste management problems. The majority of respondents agreed that BNS’s profits have been on the increase since 2005, most of the profits were derived from clients who are ‘green’ friendly, the increase in profits were partly due to good waste management system of BNS and the profits are comparatively higher than other nearby shipyards. Effective waste management and implementation are related to good waste management planning, the nature of its waste management authority, an appropriate level of its waste management awareness and a concerted customer-focus approach. The majority of respondents agreed that BNS has implemented its own kind of waste management system, it has reused or recycled scraps or off-cuts, has proper waste disposal areas, has regular disposal of its waste and is planning to implement ISO 14000:2004.
With regards to the nature of its waste management authority, the majority of respondents agreed that BNS has an effective department looking after its environmental interests, the environment department is doing a good job with its current number of staff, and a good waste management system is well implemented in all departments of BNS.

Figure 2: Level of Company Profit

Figure 3: Waste Management and Implementation

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Indicative level of waste management awareness revealed the majority of respondents agreed that workers know the importance of a good waste management system, workers know the benefits of ISO14000:2004 and the company endorses its workers to reduce waste and improve waste management costs through the reusing, recycling and reducing of its production waste. Focusing on its customers is in line with good quality management principles. Majority of respondents agreed that BNS takes customers’ complaints about waste management more seriously, the company had acknowledged customers’ request for implementation of ISO14000:2004 and understanding of customers’ satisfaction bodes well with company’s effort in maintaining of its business sustainability and future survivability. A simple scatter plot (Figure 4) involving profit margin against company’s waste management implementation indicated that there is positive correlation between company’s bottom line (profits) and waste management implementation. Increases in one variable are correlated with increases in other variable. Similarly, decreases in one variable are correlated with decreases in other variable.

A Pearson’s r results (Table 1) between company bottom line and waste management implementation ($r = 0.557, p < 0.05$), and the Sig. (2-tailed) being less than 0.05 means that there is a statistically significant correlations between the two variables. This implies that an increase or decrease in one variable significantly results in an increase or decrease in the other variable.
Table 1: Pearson’s r result

<table>
<thead>
<tr>
<th></th>
<th>Company Bottom Line</th>
<th>Waste Management Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
<td>.557**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>55</td>
<td>55</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed)

The Pearson’s r being close to 1 means that there is a strong relationship between two variables. Therefore, changes in one variable are strongly correlated with changes in the other variable. This shows that there is a strong relationship between company’s profits and its waste management implementation. The Pearson’s r being positive indicates that as one variable increases in value, a corresponding increment in value results in the other variable. Similarly, as one variable decreases in value, the other variable also tends to indicate a decrease in value. This is called positive correlation. Since the Pearson’s r is positive, it generally means that better implementation of waste management results in better company profits (Bellandi, 2004). Good management practice of a company is one that is based on a learning curve, well supported statistically and proven by a continually positive annual returns in its balance sheet.

CONCLUSION

The results of this research revealed a positive correlation between effective waste management implementation and planning, and good company profits. This indicated that good implementation of waste management system in BNS has actually resulted in increased company profits and this is in line with findings by Salman (2003). The findings generally helped unraveled grey issues pertaining to relationship between effective production waste management on a company’s bottom line.
Effective utilization of resources such as raw materials would help reduce operational costs by cutting down on cut-offs and scrap metal issues. Better management in the disposal of other types of scheduled wastes would impact a positive image on company’s reputation, increase customer satisfaction and improve recurring orders. This would surely bode well in an industry that is driven by a strong desire to reduce operating costs while maintaining competitive strategies among its many players.

RECOMMENDATIONS

BNS must continually take heed in the management of its production waste. Implementation of ISO 14001: 2004 (Environmental Management System) would greatly help BNS to enhance further its bottom line by reducing its operational costs. A more systematic and effective approach in the management of its production waste on its premise would greatly help in turning it into the premier regional shipbuilder and ship repairer. The ISO 14001: 2004 would be seen as an important ingredient for the company’s credibility and further business sustainability in the industry.

REFERENCES

METHOD OF SAND MOLDING IN THE PRODUCTION OF SHIP PROPELLER

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ABSTRACT

The propeller is the most important equipment in the propulsion system of the ship. Ship propeller made by various methods such as machining, joining and forming (casting). This paper explored the process of propeller production with casting method by sand molding. In the present, the standard operating procedure in propeller casting process is not documented as guidance for other related people who involved in studying the propeller manufacture. The review and finding the information obtained is through reading and references from books, journals and the results of observations of the industry visit. This exposure will produce the sample document in propeller casting process by sand molding method. The importance of the specific process of casting process to be viewed in various angles and to be documented. It is believed that the exposure to the manufacturing process can help researchers in an effort to manufacture better quality products.

Keywords: Propeller, Manufacturing, Exposure, Casting, Quality.

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INTRODUCTION

Ship propeller is the most important equipment in the propulsion system of the ship (John Carlton; 2007). It is produced through several methods such as casting, forming, machining, and grafting. Casting method is most popular, because it is more economically based on low operating costs such as production time is short, less waste, less manufacturing equipment and various types and size of the propeller can be made.

Most sand casting method use silica sand (SiO$_2$) as the mold material due to inexpensive and can stand for high-temperature of melting point. There are two general types of sand; naturally bonded (bank sand) and synthetic (lake sand).

Although the sand grade depending on the grain size were to be considered on the packed closely and forming a smooth mold cavity surface. These will be involved the mold permeability where to allow gases and steam evolved during the casting to escape easily.

The mold also should have good collapsibility to allow the casting to shrink while cooling and thus to avoid defects in the casting, such as hot tearing and cracking.

METHODOLOGY

The study started to review the manufacturing books related to the sand casting mold method for the various products aims to the symmetric shape such as piping, ring, bottle and etc. The contents collection will be culled from the journal paper, which replies the new concepts in sand mold casting. These theories information was written accordingly to the ship propeller manufacture and the reality in the manufacturing process were being endorsed by industry site visit.

There are two site visits had been performing in regional areas and some data had been collected in verified the process in the sand casting procedure. In the final of writing, the result of knowledge finding will be discussed in the following chapter.
RESULT AND DISCUSSION

The process flow beginning from propeller design base on engineering requirements and generated the pattern through the construction according to the correct justification. Then the mold to be prepared where the mixed sand with the combinations of crushed sand and bonding material according to a certain ratio. Casting materials prepared in accordance with the required composition and melted in a furnace. This molten metal will be tested to ensure it meets the technical specification and to be verified before transfer to Ladle for pouring into molds. Molten subsequently let solidified in the mold at the specified time period prior, to be removed from the mold.

This product will experience cleaning and finishing process of machining, so that the product can be sized according to the specification. The recovery work done such as blade thickness and surface clearing, rake angle adjustment, hub-bore lock groove, tapered hub and Propeller balancing. The last process of the stage is to record and coding the product specification before being packaged for delivery to the customer. This process flow has shown in Figure 1: Outline of production steps in a typical sand-casting operation [Mikell et. al; 1996].

![Figure 1: Outline of production steps in a typical sand-casting operation](image)

**Propeller Pattern**

The pattern is constructed for production, according to the specific design as engineering requirement. Materials commonly used are wood or fiberglass because of cheap, easy to malleable and lasts longer. The other materials will be poly-carbonate, metal and ceramics. Figure 2 shows the engineering drawing of the propeller.
Figure 2: Engineering Drawing – Propeller [John Carlton; 2007]

Figure 3 shows the example of pattern under construction and completed pattern ready to be used. There are two types of patterns which had been shown in Figure 4.

Figure 3: Propeller Pattern [ABS; 2009]; (1) under construction; (2) Ready to used.

Figure 4: Pattern Types [ABS; 2009]; (a) single blade probe; (b) full set blades probe.
Mold Preparation

Molding is a process to make a mold for casting process where it has two parts, the top section and bottom section. A complete mold is described as shown in Figure 5 and Figure 6. The mold is a combination of molding and frame where the formation of the mixture of crushed sand and rebounding materials with the solidified ratio will firm the mold. The frame or Flask is made from hardened metal and consisted upper frame is called as cope and lower frame called a drag. The process flow started with the selection of propeller pattern and following the step as described in this section. Mold preparation of the Bottom section (drag); placing sand mixed with the adhesive into the flask with the appropriate rate of third flask level. Place the pattern in the middle of the flask and use a vibrator, to compress the sand and face-to-bottom pattern formation is formed. Sand will harden in a few minutes, which will change color from brown to reddish. Remove the pattern and note the cavity surface finish so that no surface defects and surface shape is formed by perfect. The illustration of the lower section of mold is shown in Figure 5.

![Figure 5: The illustration of Bottom section (drag) [ASTM; 2003]](image)

Preparation of the top section (cope); Put the mold pattern into the (drag) and connect the flask. Place the sprue-Pouring cup in the center (hub) and rising core pattern at the end of the blade pattern. Fill sands ticker and use the vibrator to compress the sand with pattern. Remove the sprue-Pouring cup and rising core. Wait until the hard sand and lift the flask (cope) with caution. Remove the pattern from the mold and look at the mold cavity surface finish. To do repairs if there is a defect. The Argon gas or Nitrogen Gas will be injected for the mold forming.
After the surface of the cavity was determined neat and perfect, apply a surfacing solution by coating the cavity surface of the Top section mold (cope) and Bottom section mold (drag). Combine the two halves of the mold and put some sand on the outside of the frame, to prevent liquid metal from leak out during the pouring process. Leave it for a while and mold ready for use.

**Melting Process**

Melting process is a process to melt some solid material to obtain the required material mixture. The furnace is used for this process where the materials will be heated at melting temperature in appropriate time. There are two types of furnaces such as Electric-Arc or Induction Furnace and Fuel-Gas or Crucible Furnace. The selection of Furnace is based on several characteristics such as melting capacity, weight (kilogram/heat), fuel consumption (liter/minute), electric consumption (kilowatt/hour), the production capacity and facility availability. Figure 7 shows the types of Furnace which used in propeller manufacturing.
During the melting process, some additives such as magnesium, nickel, or aluminum are added to certain percentage weight to generate the product according to specification. The temperature readings will be monitored by pyrometers and material samples are taken to ensure that the percentage of material composition meets the standard. The process temperature should be at ideal temperature before pouring into Ladle where the temperature is 10% more than melting temperature. The usual temperature for Ni-manganese bronze is 1060°C and Ni-Aluminum bronze is 1100°C. This process took about 8 hours before the molten can be used for casting. Materials standard is to follow the IMO standard and Table 1 shown the materials composition. These contained a mixture of different effects in terms of strength, corrosion a resistance and inflexible in their products. The commonly used standard cast copper alloys for propellers are subdivided into the grades depending on their chemical composition.

Table 1: Chemical composition of standard cast copper alloys for propeller
[Germanischer Lloyd; 2009]

<table>
<thead>
<tr>
<th>Casting grade</th>
<th>Chemical Composition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cu</td>
</tr>
<tr>
<td>Mn-bronze,CU 1</td>
<td>56-62</td>
</tr>
<tr>
<td>Mn-Ni-bronze,CU 2</td>
<td>50-57</td>
</tr>
<tr>
<td>Ni-Al-bronze, CU 3</td>
<td>77-82</td>
</tr>
<tr>
<td>Mn-Al-Bronze, CU 4</td>
<td>70-80</td>
</tr>
</tbody>
</table>

**Pouring Process**

Molten metal is poured into LADLE as at ideal flushing and at a temperature higher than the melting temperature, to avoid harden metal in LADLE. Pouring temperature is called the **tapping temperature** and usually more than 10% of the melting temperature [Mikell et. al.; 1996]. Before discharge from the furnace, LADLE must be heated up in advance by the **Preheater** as at temperature 350°C. This is to prevent the molten temperature drop dramatically, which will cause a disruption to the flow of molten in Mold.
The material is poured into the mold through the Pouring Cup through the runner system as quickly as possible and done gently in order to minimize turbulence flow and temperature drop during the casting process until the molten metal spilling through Raiser Head. To ensure that the molten metal filling the space with a perfect in the mold cavity, a small force applied to the mold.

**Freezing Process**

The freezing process of molten metal is covering two stages, the process of hardening and cooling process. During the hardening phase of where it takes about an hour and the next is the cooling stage where the product will be left in the mold for 12 hours up to 24 hours, depending on the size and weight of the product [ASTM; 2003]. A pre-product removed from the mold base by dissolving the sand mold from the frame (flask) and will be left for a while, up to room temperature, before being sent to the machining for finishing work. Through this method, the freezing process is highly dependent on several factors such as melting temperature, mold temperature, casting materials and characteristic of the mold.

The first process after lifting the casting is fettling, which involves the removal of all extraneous riser and venting appendages. Next, the general dimension of the propeller is checked and various datum lines are established by means of measurement, whereupon the propeller is bolted to its shaft axis horizontal to a large horizontal boring machine.

**Finishing and Refining**

The next stage in production is the Finishing which started by lining out of the blades in order to determine the amount of material to be removed. Machining is a process to remove the abundant part and performing the boring and shaping for the hub. Eventually the propeller needs refining where the blade edges, rake angle, leading and trailing are contoured to the designed shape, then surfacing polished. The propeller is then statically balanced as the final stage of manufacture. The inspection procedure is carried out with the aid of purpose-built machines and it is related to the quality assurance. The illustration of the whole process was explained as in Figure 8. Some of the tests such as balancing check, there are 2 types, static and dynamic. Static unbalance is gravity at work. If a propeller is placed between centers on frictionless rollers the heavy or weighted portion will rotate to the bottom immediately.
This is corrected by adding or removing weight from the propeller. When Static balancing method is used, the propeller is attached to a steel rod. Then, it will put on a roller table. If there has unbalance weight of the blade, the weightiest part will go down. The grinder will be used to reduce the weight to get balance with other blade. Dynamic balancing of a propeller is done to provide for the lowest level of vibration in its operating range.

Professional Dynamic Balancing use sensors to provide data to a digital processor during brief engine runs as at 400rpm. Corrective weights measured to the 1/10th gram are temporarily placed under spinner screws or starter ring gear, which is measured to ± one degree. After surface finishing, the propeller is ready for packaging. Normally, they will be put into wood box and cover it with plastic and ready to export.

**Standard Quality**

Quality products are assessed based on its mechanical properties such as durability, strength, resistance to corrosion, and hardness. But the main factor taken is Yield Strength, Tensile Strength and Elongation. The data shown in Table 2 are the four types of material that have been classified by some a propeller classification body, such as Det Norske VERITAS (DNV), Lloyd Register (LR), American Bureau of Shipping (ABS) and Germanisyer Lloyd (GL).
Table 2: DNV Mechanical properties of copper alloy propeller castings [DNV; 2011] [LR; 2000]

<table>
<thead>
<tr>
<th>Alloy Type</th>
<th>Yield Strength $R_{P0.2}$ [N/mm²] min.</th>
<th>Tensile strength $R_{U}$ [N/mm²] min.</th>
<th>Elongation A [%] min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mn-bronze, Cu1</td>
<td>175</td>
<td>440</td>
<td>20</td>
</tr>
<tr>
<td>Mn-Ni-bronze, Cu2</td>
<td>175</td>
<td>520</td>
<td>18</td>
</tr>
<tr>
<td>Ni-Al-bronze, Cu3</td>
<td>245</td>
<td>590</td>
<td>16</td>
</tr>
<tr>
<td>Mn-Al-Bronze, Cu4</td>
<td>275</td>
<td>630</td>
<td>18</td>
</tr>
</tbody>
</table>

CONCLUSION

The propeller production process is done by various methods and casting methods as become a popular process. The process begins with the designing, Pattern development, mold preparation, melting materials, molding and machining as a last resort to meet the product specification. Selection of materials and product measurement will in fluency the casting process such as melting temperature, mold size, freezing, cooling and refining time. However, the selection of material is subject to the standards set by the world body classification. Product evaluation based on mechanical properties tests performed on a random product. The last stage before it is used is to make sure this propeller balance test. High quality Propeller has undergone a complete manufacturing process and certified to meet the quality standards set.

REFERENCES


ABSTRACT
The aim of this paper is to provide an explanation about diffusion welding, subsequently justification and suggestion for the introduction of diffusion welding as one of the research area at UniKL MIMET research laboratory. The diffusion welding is considered as one of the advanced methods of joining processes which normally used to fabricate parts that require high quality and strong welds, involving intricate parts that are costly or impossible to manufacture by conventional means or when the materials used are not suitable in a conventional fabrication process such by the fusion welding. This specialized welding process has found considerable acceptance in the manufacturing of aerospace, nuclear and electronics components. The authors observed that the process has a great potential to be applied in marine industry as well, for example in the joining of dissimilar metals such as aluminium and steel, cast iron and steel, titanium and steel and etc. for the construction of ship hull and ship machinery systems. With the introduction of this as one form of clustered research area at UniKL MIMET, a big number of staff and students would be able to expand and advancing their knowledge and experience on advanced joining methods, its strength quality testing as well on advanced material metallography examination and analysis.

INTRODUCTION TO DIFFUSION WELDING RESEARCH LABORATORY AT UniKL MIMET

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ABSTRACT
The aim of this paper is to provide an explanation about diffusion welding, subsequently justification and suggestion for the introduction of diffusion welding as one of the research area at UniKL MIMET research laboratory. The diffusion welding is considered as one of the advanced methods of joining processes which normally used to fabricate parts that require high quality and strong welds, involving intricate parts that are costly or impossible to manufacture by conventional means or when the materials used are not suitable in a conventional fabrication process such by the fusion welding. This specialized welding process has found considerable acceptance in the manufacturing of aerospace, nuclear and electronics components. The authors observed that the process has a great potential to be applied in marine industry as well, for example in the joining of dissimilar metals such as aluminium and steel, cast iron and steel, titanium and steel and etc. for the construction of ship hull and ship machinery systems. With the introduction of this as one form of clustered research area at UniKL MIMET, a big number of staff and students would be able to expand and advancing their knowledge and experience on advanced joining methods, its strength quality testing as well on advanced material metallography examination and analysis.
With a strong knowledge on materials and on the advanced joining, it is likely that this welding technique could soonest be applied for the marine industry application for example for shipbuilding and offshore structure construction.

**Keywords**: Diffusion welding; Research laboratory; Dissimilar Metals.

**INTRODUCTION**

**Definition of Diffusion Welding**

Diffusion welding is a joining process between materials wherein the principal mechanism for joint formation is solid state diffusion. Coalescence of the faying surface is accomplished through the application of pressure at elevated temperature. No melting and only limited macroscopic deformation or relative motion of the parts occurs during welding. Microscopic deformation followed by recrystallization occurs.

Near the weld zone, self-diffusion in the same materials and inter diffusion between the materials takes place simultaneously. New crystalline forms of the original elements and inter-metallic compounds may grow during the process \(^1\). Other terms which are sometimes use synonymously with diffusion welding include diffusion bonding, solid state bonding, pressure bonding, isotactic bonding, and hot press bonding \(^1\).

**Diffusion Welding Process**

For conventional diffusion welding, without a diffusion aid, a three-stage mechanistic model, as shown in Figure 1, adequately describes weld formation. In the first stage, deformation of the contacting asperities occurs primarily by yielding and by creep deformation mechanisms to produce intimate contact over a large fraction of the interfacial area.

At the end of this stage, the joint is essentially a grain boundary at the areas of contact with voids between these areas. During the second stage, diffusion become more important than deformation and many of the voids disappear as grain boundary diffusion atoms continues.
Simultaneously, the interfacial grain boundary migrates to an equilibrium configuration away from the original plane of the joint, leaving many of the remaining voids within the grains. In the third stage, the remaining voids, are eliminated by volume diffusion of atoms to the voids are surface (equivalent to diffusion of vacancies away from the voids). Of course, in a real system, these stages overlap, and mechanism that may dominate one stage also operate to some extent during other stages [2].

**Diffusion Welding - Process Variables**

Diffusion welding may be carried out in air (under atmospheric pressure) or in a vacuum. When the process is conducted in vacuum, the mating surfaces are not only protected against further contamination, such as oxidation, but are cleaned, because the oxides present dissociate, sublime, or dissolve and diffuse into the bulk of the materials. The success or failure of the process is decided by three variables which need a constant watch and careful adjustment. These variables are the bonding temperature, the bonding pressure (or pressing load), and the holding time (duration of pressure [3]). The bonding temperature should be anywhere between 50% and 70% of the melting point of the most fusible materials in the compositions. Elevated temperature aids the interdiffusion of atoms across the interface of the weld, and this assists surface deformation (the crushing of surface asperities [3]. The bonding pressure or pressing load should ensure tight contact between the edges of the pieces. It must be sufficient to aid deformation of the surface asperities and to fill all the voids in the weld zone.
If the pressure is not sufficient, some of the voids will be left unfilled, and the strength of the joint will be impaired. Importantly, the pressing load disperses load oxide films—this leaves a clean surface, and aids the diffusion and coalescence [3]. The holding time (duration of pressure), at a specified bonding temperature and a specific bonding pressure, must in most cases be kept to minimum from physical and economical consideration. It should be just sufficient for an intimate contact to be formed and for diffusion processes to take place. An excessive diffusion time might leave voids in the weld zone or even change the chemical composition of the materials or lead to the formation of brittle intermetallic phases (when dissimilar metals or alloys are being joined) [3].

During welding, a solid filler, insert, or interlayer metal may be used between the fraying surfaces. This is another variable which might later change the characteristic of conventional diffusion welding [3]. Surface preparation plays an important role for a good joint formation especially when bonding is carried out in air. Hence all above possibilities for carrying out diffusion welding, may result in different characteristics and quality of joint formation.

**Diffusion Welding Application**

The diffusion welding process is normally used to fabricate parts, when highly-quality and high-strength welds are required, where part shapes are intricate and would be costly or impossible to manufacture by conventional means or when the materials used possess unique properties that interfere with, or area difficult to maintain during conventional fabrication processing. This specialized welding process has found considerable acceptance in manufacturing, aerospace, nuclear and electronics components [1]. Most applications involve alloys of titanium, nickel and aluminium, as well as dissimilar materials combinations [1].

Cast iron which is poorly weld able by fusion welding because it tends to crack in the near-weld zone both during and after welding, is weld able by diffusion welding with good joint formation. This makes diffusion welding an ideal process in manufacturing composite parts from cast iron such as machine bases and supports, brake component etc. [4]. Diffusion welding has been used for joining steels for specialised application where high quality joints are required between large, thick and flat surface objects [1]. Diffusion welding is a process area that will find broader use with time but requires more development to reach this expanded status [1].
**Diffusion Welding Advantages**

Several kinds of metal combination can be joined by diffusion welding:

1. Similar metals may be joined directly to form a solid-state weld. In this situation, required pressures, temperatures, times are dependent only account the characteristics of the metals to be joined and their surface preparation.
2. Similar metals can be joined with a thin layer of a different metal between them. In this case, the layer may promote more rapid diffusion or permit increased micro deformation at the joint to provide more complete contact between the surfaces. This interface metal may be diffused into the base metal by suitable heat treatment until it no longer remains a separate layer.
3. Two dissimilar metals may be joined directly where diffusion-controlled phenomena occur to form a bond.
4. Dissimilar metals may be joined with a third metal between the faying surfaces to enhance weld formation either by accelerating diffusion or permitting more complete initial contact in a manner similar to category (2) above.

Some of the advantages of diffusion welding are:

1. Joint can be produced with properties and microstructures very similar to those of the base metal. This is particularly important for light weight fabrications.
2. Component can be joined with minimum distortion and without subsequent machining or forming.
3. Dissimilar alloys can be joined that are not weld able by fusion processes or by processes requiring axial symmetry.
4. A large number of joints in an assembly can be made simultaneously.
5. Components with limited access to be joints can be assembled by these processes.
6. Large components of metals that required extensive preheat for fusion welding can be joined by these processes.
7. Defects normally associated with fusion welding are not encountered.

8. Economic advantages
   i. Simple starting blank form (particularly significant for titanium)
   ii. High material utilization
   iii. Reduces parts count
   iv. Process times which are insensitive to size, complexity of structural form, or number
       of components manufactured in one operation.

9. Weight advantages
   i. These weight saving occur from the ability of SPF/DB in particular, to produce efficient
      structural forms with the elimination of fasteners and associated joint flanges.

_Diffusion Welding Equipment / Apparatus_

The apparatus for diffusion welding is designed to provide compressive loading (pressing) and heating in a vacuum at the interface of a specimen to be joined. A typical configuration of the working part of the apparatus is shown in Figure 2. This typical apparatus and its operation are best described by considering individually the system which provides the vacuum, compressive load and heating. This apparatus has a vacuum system consists of a 700 W oil diffusion pump backed by 400 W oil sealed rotary pump with appropriate vacuum chamber, manifold, valves, baffle and gagging. The vacuum obtained in the vacuum chamber (quartz tube in Figure 2.) by the rotary pump is in the order of $10^{-2}$ Torr and by the diffusion pump, in the order of $10^{-5}$ Torr.

The loading system is a hydraulic press consisting of a hydraulic hand pump, hydraulic cylinder and rams, a load cell with appropriate instrumentation, and the necessary support. The load cell output is recorded on a strip chart recorder. Alumina rods are used in contact with the specimen on both the loading ram and the supporting pedestal. The alumina is used for elevated temperature compressive strength, and because it is less likely to react chemically or bond than a metal ram in contact with the specimen.

The heating system consists of a 4.8 KW infrared image furnace and a unit of an automatic thermal program controller. A CA thermocouple (0.3mm thick) is percussively welded to the specimen within 2 mm of the joint interface to measure and control the temperature of the specimen.
The temperature is indicated and recorded on a strip chart recorder. This heating method (the use of IR lamps) provides a number of attractive properties, such as high luminous flux density and freedom from time lag (the flux reaches 99% of its maximum value in a split second, because around 80% of energy input is emitted as radiation).\[^5\] By utilizing an automatic thermal program controller, the heating rate is kept constant, holding time perfectly attained, and the specimen is kept at a desired welding temperature to maximum accuracy, with almost no fluctuation in temperature throughout the welding.

**Diffusion Welding Procedures**

**Materials and Specimen Preparation for Diffusion Welding**

Parent materials/metal are to be cut in a lathe to cylindrical specimen of sizes 12 X 10 mm and 14 X 20 mm for metallographic observations and tensile test specimens respectively. These specimens and their assembly are shown in Figure 3 and Figure 4.
The specimen ends to be joined are polished on 240 grit emery paper and cleaned with alcohol to remove any loose grit or dirt and grease or other contaminants. These end faces are then wire brushed with a stainless steel wire brush (wire 0.3 mm diameter and 20 mm long) towards the polishing scratch directions, cleaned again with alcohol and blown dry. A thermocouple is later percussively welded to one specimen within about 2 mm of the bond interface. This specimen in a couple with another specimen is immediately placed in the apparatus.

**Welding Procedure**

The specimens are positioned in the apparatus as shown in Figure 2. The specimens are set between the pressing axes of the alumina rods in such way that the polishing scratches together with the brushing mark directions on each of the mating surface are mutually perpendicular. The chamber is then evacuated; first with half an hour by rotary pump then switched over to the diffusion pump for another one hour vacuuming.
Using an automatic thermal controller, the desired bonding temperature, hold time and heating rate are programmed. Immediately after the load is applied, heating is started. The load is maintained constant until the end of the hold time and then allowed to reduce by itself. At completion of the cycle the specimen is allowed to cool to less than 100°C before removing the vacuum. This is to avoid oxidation which may take place at higher temperature if the vacuum is removed.

**Metallographic Preparation and Examinations**

After diffusion welded, the specimens for metallographic observations are sectioned axially into two halves and each half is prepared for metallography. They are mechanically polished on succession of 120, 240, 400 and 600 grits emery papers before final polishing on metallographic cloths moistened with a diluted solution of alumina particles of 0.5 micron and 0.05 micron sizes successively. The specimen are then first etched in natal solution (100 ml methanol + 4 ml nitric acid), then dried and etched in concentrated nitric acid solution. Photographs of the prepared metallographic specimens, in the vicinity of diffusion zones, along the bonding interface are then taken by optical microscope. From the microphotographs the microstructures of the diffusion zone are examined and the diffusion layer thickness measured directly. Below Photo 1 is a typical example of the microphotograph and Figure 5 is a measurement of the diffusion layer thickness.

![Photo 1. Microphotograph of diffusion of Nickel to Iron diffusion couple.](image_url)
Figure 5. Temperature dependence of thickness of diffusion layer for Ni-Fe diffusion couple.

Electron probe analysis may also perform on some of these specimens to determine composition as typical examples in the Figure 6 and Figure 7 below.

Figure 6. EPMA scanning profile of Ni-FCD diffusion layer

Figure 7. EPMA X-ray image of Ni crossing the diffusion zone of Ni- SK3 diffusion couple
Mechanical Properties Preparation and Testing

Tensile Tests

The specimens for joint mechanical properties are to be machined from blanks as shown in Figure 4 (after diffusion welding). The configuration of tensile test specimen is shown in fig 8. Tensile test are carried out at a crosshead speed of 1.0mm/min at room temperature. The ultimate strength and location of fracture are determined. Figure 9 is typical example of a tensile strength graph.

Figure 8. Dimensions and configuration for the tensile test specimen.

Figure 9. Tensile strength of Nickel to Irons and Steels joints
The fractured surfaces are analysed by X-ray diffractometer using Cu-K radiation. Fractured surfaces are observed by Scanning Electron Microscope (SEM) and fractographs examined. SEM photographs of these interface fractured specimens are also taken. Below figure 10 is an example of a typical fractographs of tensile tested joints.

![Fractographs of tensile tested joints](image)

**Figure 10. Fractographs of tensile tested joints**

**Hardness Tests**

The metallographic specimens are also used for hardness testing. In a typical test, the micro hardness tester of Vickers hardness testing machine is employed with loads of 5 and 10 grams. The hardness is measured across the welding interface.

**Other Mechanical Tests**

The metallographic specimens may also use for testing of impact strength (brittleness), bending, creeping, fatiguues and other relevant mechanical testing.

**Diffusion Welding Analysis and Objectives**

Diffusion welded specimens are subject to a range of possible welding process variables and parameters and subsequently undergoing various metallography examination and mechanical testing analysis with the objectives to determine and search for the best quality of the joints as well to identify the optimum conditions and parameters of the joining. These results would become the basis for the comparison against other available joining techniques such as to determine the advantages and the disadvantages and to provide evidences for the potentiality of the techniques to be applied towards product creations.
BENEFITS

By introducing diffusion welding as one of the research area at UniKL MIMET research laboratory, below are benefits and outcomes that are directly and indirectly that could be expected and considered.

Clustered Research Laboratory

Diffusion Welding Laboratory shall be equipped with equipment for the joining of dissimilar metals and materials and for the subsequent various mechanical testing and microstructure examination and analysis. This research area involves almost unlimited possibility numbers of parameters and variables such as Temperatures, Pressure, Vacuuming, Time/Duration and various types of metals and non-metals that are possible to be joined. Various types of Mechanical Testing and materials microstructure examination and analysis are other possible variables in this research. Hence almost unlimited numbers of staff and students could be involved in this clustered research area.

MIMET Materials Laboratory Enhancement

Under TECHFO (Technical Foundation) section, material laboratory has been undergoing upgrading with the purchases of numbers of materials related testing and examination facilities that capable to conduct industrial testing and research activities such as Universal Testing Machine, Charpy Impact, Hardness testing, Ultrasonic Testing, DPI/MPI, Scanning Electron Microscope (SEM), Spectrometer, heat treatment furnace and testing specimens preparation equipment. This equipment were purchased for the needs of conducting destructives testing (DT) and non-destructive testing (NDT) of practical tasks of Ship Materials subjects that being offered for the Diploma and the Degree programs. With the introduction of diffusion welding lab within this material lab, this could expand the benefit of such investment in that testing equipment being solely a teaching aid to a return in the research and industrial application. With a few more equipment that need to be purchased such as X-ray Diffractometer, X-ray Flaw Detector, fatigue failure tester and Radiography Tester that would make MIMET’s materials laboratory and ideal place to conduct teaching delivery for the Master Programs and for research activities as well for industrial testing needs. Meanwhile to conduct basic diffusion welding research, the existing testing/examination equipment are found to be sufficient.

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**Materials Science and Engineering Knowledge Advancement**

Materials science, also commonly known as materials engineering, is an interdisciplinary field applying the properties of matter to various areas of science and engineering. This relatively new scientific field investigates the relationship between the structure of materials at atomic or molecular scales and their macroscopic and mechanical properties. In recent years, materials science is becoming more widely known as a specific field of science and engineering. It is an important part of forensic engineering (Forensic engineering is the investigation of materials, products, structures or components that fail or do not operate or function as intended, causing personal injury or damage to property.) and failure analysis, the latter being the key to understanding, for example, the cause of various machineries and vehicles related accidents. Many of the most pressing scientific problems that are currently faced today are due to the limitations of the materials that are currently available and, as a result, breakthroughs in this field are likely to have a significant impact on the future of technology.

By embarking a research on the diffusion welding, an analysis on the diffusion welded joints at microstructural level and their correlation to the mechanical properties, these would enhance and expands MIMET’s researchers’ (staff & students) knowledge and experience in the area of material science and engineering pertaining to shipbuilding, marine structure and marine vehicles design, construction and operations.

**Advanced Joining Knowledge and Experience Advancement**

Joining processes are an important key factor for the competitiveness of European shipbuilders. They not only represent a significant portion of the total man hour consumption in hull production and outfitting, but due to heat distortions they also have a significant impact on non-productive work operations, such as straightening and fitting. Those operations can interfere with on-board outfitting and increase lead time and construction cost. In addition to their contribution to shipyard productivity, joining techniques have a significant impact on material properties and thus on product performance and quality. Those factors become increasingly important for complex structures using comparatively thin and high-strength materials. Considering the importance of efficient joining, European shipbuilders in the past decade have invested significant efforts to develop new joining techniques, such as laser welding, adhesive bonding, and mechanical joining.
Advanced join techniques being employed to reduce material distortion, for high quality joints, to certain extent to reduce production cost and as an alternative for materials or parts or products that are least possible to use the conventional fusion welding. Diffusion welding is one of the advanced joining techniques that could be explored for that purposes. By embarking research on the diffusion welding, knowledge and experience on advanced materials and advanced joining techniques would be enhanced and being elevated to a level where MIMET’s staff and students acquiring a technology towards creativity and innovation of products in line with the needs of the industry.

**MIMET Workshop/ Shipyard Welding Enhancement**

As per the curriculums requirement, MIMET welding shops are being equipped with the conventional fusion welding equipment and techniques that are also currently employed by our local marine industry. While we are maintaining this conventional technology for skills and knowledge dissemination among students and staff and to meet the current and immediate needs of the local industry, efforts should be made to explore others various advanced joining techniques that either already being applied or undergoing research by for examples world class shipbuilding in Europe, South Korea and Japan. By conducting research on the diffusion welding, there is a possibility for the introduction of this technique for a practical application at MIMET’s welding shops as well for the marine industry.

**Marine Industry Potential Application**

Explosion welding is being applied in the mass production of ‘triclad’ of aluminium and steel joining which is used as transition joints for ship of steel hull and aluminium superstructure and other ship applications. Some disadvantages of this process are it requires high energy explosive materials to be used and have to be conducted remotely as it produces incredible noise. Diffusion welding shall be explored as the alternative process to the production of these transition joints. Special grade stainless steel, titanium, non-magnetics steel, cast steel, forged steel, copper nickel steel, cast iron and aluminium are some examples of metals and alloys that are commonly used for ship hull components, piping system, equipment components especially for naval vessels that are hardly to be joined by the conventional fusion welding methods. Applied diffusion welding techniques should be considered for a better quality and more efficient way.
Powdered Metallurgy Related Research

Equipment for the diffusion bonding could be also used for conducting research on a material processing method of powder metallurgy. Powder metallurgy is the process of blending fine powdered materials, pressing them into a desired shape or form (compacting), and then heating the compressed material in a controlled atmosphere to bond the material (sintering).

The use of powder metal technology bypasses the need to manufacture the resulting products by metal removal processes, thereby reducing costs. With minor additional accessories such as moulding dies needed, interested lecturers could use the same equipment of diffusion bonding to conduct research on powder metallurgy.

Diffusion Welding Equipment Development & Acquisition

Equipment to perform joining or welding of materials is one of the major factors for the advancement of the materials and diffusion welding research area. Locally fabricated or direct purchase is being considered.

Student FYP

In-house design and external locally fabricated was one of the options that being explored for a lower price to own the diffusion welding equipment. This was done through a student Final Year Project. Students being guided to design the equipment’s subsystems components and the complete assembly to generate bill of materials together with the estimated cost till getting quotations and identify potential fabricator or suppliers.

Direct Purchase

A complete system of diffusion welding direct purchased from abroad is another option but the price could be very high. A specification for the diffusion welding components as design requirement is tabulated in Table 1. Basically it requires compact pallet as shown in Figure 11.
Figure 11. Compact pallet diffusion bonding equipment.

Table 1. Specification for compact pallet of diffusion bonding equipment

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Max.</td>
<td><strong>6 metric tons (10 MPa on pressure gauge)</strong></td>
</tr>
<tr>
<td>Hydraulic Pump</td>
<td>12T manual pump is built-in on the bottom of frame</td>
</tr>
<tr>
<td>Bottom Hydraulic Cylinder Travel Distance</td>
<td>25 mm</td>
</tr>
<tr>
<td>Top Support Screw Adjustable Height</td>
<td>150 mm</td>
</tr>
<tr>
<td>Heating Chamber &amp; Temperature Control</td>
<td>- Split furnace with 55mm diameter heating chamber</td>
</tr>
<tr>
<td></td>
<td>- Max. working temperature: 1100°C</td>
</tr>
<tr>
<td></td>
<td>- 30 segments programmable temperature controller with auto tune PID and over-heating protection</td>
</tr>
<tr>
<td>Furnace Power Supply</td>
<td>Single Phase AC 208-240V, 1.2KW</td>
</tr>
<tr>
<td>Machine Dimensions</td>
<td>292mm(L) x 279mm(W) x 546mm(H)</td>
</tr>
<tr>
<td>Net weight</td>
<td>350 lb</td>
</tr>
<tr>
<td>Shipping Dimensions</td>
<td>14&quot;(L) x 14&quot;(W) x 25&quot;(H)</td>
</tr>
<tr>
<td>Weight of shipment</td>
<td>410 lbs with 48&quot;x40&quot;x46&quot; dimension</td>
</tr>
</tbody>
</table>
Table 2. Estimated costing for initial cost in conducting research of this diffusion welding.

<table>
<thead>
<tr>
<th></th>
<th>Equipment</th>
<th>Status</th>
<th>Price (RM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diffusion welding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Lathe Machine</td>
<td>Available</td>
<td>-</td>
</tr>
<tr>
<td>1.1.2</td>
<td>Diffusion Welding Apparatus</td>
<td>To be purchased</td>
<td>100,000</td>
</tr>
<tr>
<td>1.2</td>
<td>Mechanical Testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.1</td>
<td>Tensile Test</td>
<td>Available</td>
<td></td>
</tr>
<tr>
<td>1.2.2</td>
<td>Hardness Testing</td>
<td>Available</td>
<td></td>
</tr>
<tr>
<td>1.2.3</td>
<td>Charpy Impact Testing</td>
<td>Available</td>
<td></td>
</tr>
<tr>
<td>1.2.4</td>
<td>X-ray diffractometer</td>
<td>Recommended to be purchased</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Metallographic Examinations</td>
<td>Available</td>
<td></td>
</tr>
<tr>
<td>1.3.1</td>
<td>Specimens preparation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3.2</td>
<td>Examinations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3.2.1</td>
<td>Optical Microscope</td>
<td>Available</td>
<td></td>
</tr>
<tr>
<td>1.3.2.2</td>
<td>Scanning Electron Microscope</td>
<td>Available</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Raw Materials &amp; Consumables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Various materials for specimens in rod form</td>
<td>To be itemised</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Miscellaneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>To be determined</td>
<td></td>
</tr>
</tbody>
</table>

Total Cost: 100,000.00

CONCLUSION AND RECOMMENDATION

Since the focus of UniKL to embark in research in becoming one of the top universities in Asia by the year 2017, UniKL Mimet is committed to materialise the research laboratory in diffusion welding. With the current development of UniKL MIMET Materials Laboratory it would inspire research culture amongst the students and as well as lecturers to pursue detail study in diffusion welding especially for the marine and ship building application.

Justification is merely based on various benefits provided by diffusion welding technique in comparison with fusion welding which has been highlighted in this article. Further study and approach on the diffusion welding process could be inculcated throughout the research period to enable astounding result. Hence continuous investigation on the massive diffusion and thin sheet diffusion bonding processes should be made possible.
REFERENCES

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THE MANDARIN ORAL TEST FOR BEGINNERS

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ABSTRACT

Conventional oral test for Mandarin Language subjects is a very formal, where the students are tested one by one and have no guide during the test. It was found that they failed the test very badly and were very scared during the test, they also had difficulties in preparing the test. Hence, conventional oral test was changed to a new format which included the mastery learning, cooperative learning and self-paced learning. It was also modified and improved by adding teaching and learning of Mandarin Phonetic System, which have greatly eased the students’ difficulties in mastering it. Listening Test was used to let students recognize and use the Chinese Characters. Students can master language skills with less difficulties and more fun now.

Keywords: Oral Exam, Listening Test, Mastery Learning, Cooperative Learning, Self-paced learning

INTRODUCTION

Mandarin language is thought as a foreign language subject in Universiti Kuala Lumpur Malaysian Institute of Marine Engineering Technology (UniKL MIMET). Students need to complete two Mandarin language subjects (Mandarin 1 & 2), for two hours per week. Both courses last for two semesters or 28 weeks. Each semester, the assessment methods consist of:

- Coursework 40%
- Oral test: 1st spoken exam 10% plus 1st Listening test 5%
- 2nd spoken exam 10% plus 2nd Listening test 5% 30%
- Written test (a summative test at the end of the semester) 30%
- Total 100%

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There is no final examination for Mandarin subjects. Mandarin is entirely different language as compared to English and Malay. Students face great problem in differentiating the four different tones. Some even cannot follow and repeat correctly. During oral test, it was found that the conventional oral test was not suitable for the beginners. This article explains the methods and the means endeavored to improve the oral test.

THE CONVENTIONAL ORAL TEST

According to the Lesson and Assessment Plan, students would had oral test this morning. Hayati was the first one to be tested, but she said that she was not ready yet, and beg to postpone the test. A month ago, each student had been given the test materials, the contents consist of Chinese characters, words, phrases, sentences, reading the texts, questions and answers, phonetic exercises, singing and reading the lyrics etc. The lecturer had taught and discussed the test materials several times in class, thus the students were expected to get ready accordingly. The lecturer told Hayati that she would be tested when she was ready, she agreed. Although she is a university student and has gone through so many tests, when facing the test, she was very scared and trembling with fear. After the lecturer tested for the first two items, she could no longer proceed with the test and left the examination room. Before leaving, she expressed her sincere apology and bowed to me. Even these two items, although she had prepared, but mostly failed. Later, the lecturer hold a conversation with Hayati. She said that she spent a lot of time in preparing. The lecturer believed in her confession, because she is a hardworking students, but still could not prepared nicely. No wonder she was afraid and trembling! The lecturer found out that the rest of the class had the same problem.

NEW APPROACH IN ORAL TEST

As a result, the conventional Oral Test was changed to a new strategy, which is by combining the mastery learning and cooperative learning together, and was used in this test. Firstly, the test was divided into two parts--individual test and group test. Instead of testing the whole paper, the lecturer separated the oral test into units or items, and test item by item. Before the test, the students were taught several times, and were also encouraged them to use cooperative learning after class.
Students prefer this approach of learning. Even individual test, students also prefer to learn in group but to be tested individually. Students preferred to do the test in a group of three to five members to avoid nervousness and fear, some group even asked to be tested first. This method has inspired their enthusiasm, and also quicken the test but their pronunciation is still very inaccurate.

**MANDARIN PHONETIC SYSTEM (HANYU PINYIN)**

Hanyu Pinyin is the lesson that the students must learn. Although they had learnt, but still could not master them accurately, not to mention the tones, hence they could not pronounce the Chinese character correctly. The phonetic systems of English, Malay and the Hanyu Pinyin although have quite a lot are the same, but they do not much help. Some students even have their own invention of phonetic systems, which make matters worse! Take simple finals **a o e i u ü** as an example, they often mixed the English and Malay pronunciation together and use the tone arbitrarily. Some even could not pronounce. Their mother tongue also using spelling system, they could not pronounce, maybe the mother tongue is easy for them to learn, so they do not emphasized in pronunciation and spelling. The textbook which is specially written by all UniKL full-time Mandarin Lecturers according to the approved syllabus, also provided with an audio CD which include almost all the texts in the textbooks, but it did not work, because the speaker speaks too fast, student could not catch up.

They never learn Mandarin before, they feel weird and wonder with the phonetic tones that discern shape or character form, meaning and sound. For example **mā bà** (mother), **má má** (hemp), **mǎ mà** (horse), **mā má** (scold), **ma ma** (question tag), same spelling **ma**, but different in tones cause to different in character form sound and meaning. In the textbooks, every characters in the dialogue are transcribed into Hanyu Pinyin. These induced the students tend to use Pinyin to learn Mandarin and ignore the Chinese Character. However, many students still could not master the tones, some of them even could not follow what the lecturer pronounced. It is after all a foreign language for the beginner, everything is new to them. Let the students to articulate the Chinese characters in correct tones and speech correct mandarin are the lecturer’s greatest challenge. So, the lecturer changed the method of teaching and learning the four tones, by adding hand gestures to indicate the tones, and asked the students to follow suit.
It was observed that they easily recognized and differentiated the tunes in this way, and can pronounce more accurately. During the oral test, whole group pronounced the character using same tone, same hand gesture, it look nice and beautiful. In this way, the students had strengthened their confidence, and test materials also increased, that also improved the quality of oral test. However, once students read or speak faster, the pronunciation and the tone will not be accurate. The lecturer encouraged them to slow down, accelerate slowly when they had mastered it. They did it with good results.

Figure 1. The pictures of 1st, 2nd and 3rd tone hand gesture.
DISADVANTAGES IN GROUP TEST

Students whom were tested together in a group of three to five, inevitably one or two of them did not cooperate. For example some may intentionally lower the sound volume so that the lecturer cannot find out his or her mistake, or read a bit slow in order to keep up with the other students. But the magic goes, the road climbs, during the group test, when the lecturer found out one or two members who did not pronounce the character correctly, or not in pace with the other members, or tones gesture wrong, the whole group was asked to go back to learn and practice again. Usually the second try will be better. This way also helped in preventing them from deceiving oneself or others.

THE ADVANTAGES OF COOPERATIVE LEARNING

The cooperative learning allows students to see the advantages to be in the team. In order to achieve the academic goals, they must work in groups to complete tasks, they must have mutual care and understanding, learn together, work together. These lead to coexistence and common prosperity, at the same time, display friendship and solidarity, proactive, voluntary dedication of wisdom and teamwork. Everyone succeeds when the group succeeds. Thus their collective consciousness, solidarity and cohesion getting stronger.

LISTENING TEST

The lecturer found that students can not recognize the Chinese characters or words. So, besides Oral Tests, there are Listening Tests, with the intention to let them recognize the Chinese characters. The lecturer offered some common Chinese characters and words, beside the character and word have number or alphabet. Then, the lecturer let the students first learn the character forms, sound and meaning of the Chinese characters and words. During the test, no hanyu pinyin was provided. The lecturer used the characters they learned to make sentence or phrase and read out, the students listened carefully, then wrote the answer by using the numbers or alphabets next to the characters or words. In addition, they also listened to the words and matched with pictures. Figure 2 shows the example of listening test.
CONCLUSION

Many students scored high marks in oral test. For the group test, it seems not objective enough, could not obviously distinguish good and poor students. But the lecturer’s objective was to let them study seriously and mastered the skills was achieved. On the other hand, the individual Oral Test can clearly distinguish students’ achievement, and promptly corrected their weaknesses. The validity of individual Oral Test is very high also, but it take time to finish the test especially to test a big crowd of students in a limited time. It also compensate the disadvantages of the group test. The Listening Test is one of the means which can bring back the students to learn the Chinese character again.

This new approach of oral test is suitable for courses which has relatively short learning time and has big crowd of students. The students are allowed to finish the oral test. This is the best time for them to arrange the suitable time to study, they can form the group according to their taste. They can come several times to test different item or items. If they fully implement it, that is the best chance for them to nurture “self-paced learning” which is very good for lifelong learning. The lecturer changed oral test to become a musical baton, directing students to learn actively and seriously. For the sake of high marks, students actively and seriously concentrate on learning. The oral test is to examine or to measure how much they had learned and mastered, not knocked them down. It also measured whether the approach taken to teach is effective or vice-versa.
End Note:

i. Learning for mastery or mastery learning, are terms coined by Benjamin Bloom in 1968 and 1971 respectively. Bloom hypothesized that a classroom with a mastery learning focus as opposed to the traditional form of instruction would reduce the achievement gaps between varying groups of students (Guskey 2007). In Mastery learning, "the students are helped to master each learning unit before proceeding to a more advanced learning task" (Bloom 1985) in contrast to "conventional instruction". (http://en.wikipedia.org/wiki/Mastery_learning).

ii. Mastery learning breaks subject matter and learning content into units with clearly specified objectives which are pursued until they are achieved. Learners work through each block of content in a series of sequential steps. Students must demonstrate a high level of success on tests, typically at about the 80% level, before progressing to new content. Mastery learning can be contrasted with other approaches which require pupils to move through the curriculum at a pre-determined pace. Teachers seek to avoid unnecessary repetition by regularly assessing knowledge and skills. Those who do not reach the required level are provided with additional tuition, peer support, small group discussions, or homework so that they can reach the expected level. (http://educationendowmentfoundation.org.uk/toolkit/mastery-learning/).

iii. An official Mandarin Phonetic System for transcribing the Mandarin pronunciations of Chinese characters into the Latin alphabet. This system started since 1958 in China. It was introduced to primary schools of Malaysia since 1983 as a way to teach Standard Chinese pronunciation.

iv. Mandarin Phonetic System (Hanyu Pinyin) have 4 basic tones, they are:

<table>
<thead>
<tr>
<th>Tone</th>
<th>Tone Mark</th>
<th>Pinyin (sound)</th>
<th>Word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>first</td>
<td></td>
<td>wā</td>
<td>挖</td>
<td>to dig.</td>
</tr>
<tr>
<td>second</td>
<td></td>
<td>wá</td>
<td>娃</td>
<td>a baby.</td>
</tr>
<tr>
<td>third</td>
<td></td>
<td>wǎ</td>
<td>房</td>
<td>a roof tile.</td>
</tr>
<tr>
<td>fourth</td>
<td></td>
<td>wà</td>
<td>袜</td>
<td>socks, stockings</td>
</tr>
</tbody>
</table>

The neutral tones (no tone mark) are tones that vary according to the character tone in front of it.

| neutral tones | wā | 娃 | a phrase-final particle |

v. In articulating the finals, we must use the first tone.

vi. A Chinese character has character form, sound and meaning, for example the form 果 (pinyin: zuò, meaning: table) only one character. 桌子 (zhuōzi) has two characters still means “table”, “桌子” is a disyllabic word, or one word with two syllables. The second character 子 original meaning is son, in this word 桌子, it is just a suffix. 马来西亚 has four characters but only one word Malaysia.

vii. Self-paced learning can subdivided into self-paced mastery learning, self-paced cooperating learning etc.
REFERENCES


SECOND LANGUAGE ACQUISITION IN SPEAKING ACCORDING TO DIFFERENT SOCIOCULTURAL AND LINGUISTIC ENVIRONMENT: LOCAL AND ABROAD SETTINGS

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ABSTRACT

English is taught in Malaysia at a very early stage. However, the acquisition of this second language is still a slow work in progress, even though the learners have completed their studies in schools, or tertiary level. Linguistic environment plays a vital role in providing an effective platform to the acquisition of second language. In regard with sociocultural theory by Vygotsky (1978), it is believed that learners will acquire the second language better when they are more exposed to the targeted language where the surrounding requires them to use the language as a mean of communication. Linguistic environment, which I believe is derived by the social environment may either hamper or stimulate the process of second language learning.

Keywords: Second Language Acquisition, Sociocultural Theory, Studying Abroad.

INTRODUCTION

English subject is being taught worldwide as it is the language of globalization. Other than self-learning aptitude, the ability to speak in second language depends on the surrounding that is lived by the learner. In Malaysia, English is widely spoken; however it is limited to only certain groups of people. These groups of people are those who are comfortable with the language, where most people around them are actually speaking it.

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According to Firth & Wagner (1997) as cited by Yamat (2012), SLA can be seen as an individualistic mental process or the process via interaction where the language is being used in a resourceful, contingent and contextual way. The sociocultural aspect created by these groups of people has made the second language as a medium of communication where the speakers are confident, comfortable and most probably have no choice, but to assimilate with the English spoken community.

As cited by Lantolf & Thorne (2006) in their studies on Sociocultural Theory and SLA, according to Luria & Yudovich (1972), a child behavior of linguistic begins in the surrounding of the child itself, in which their actions and beliefs is taken to a higher stage of development as seen practiced by the community. They will adapt to the given sociocultural background and eventually will develop their own behavior of linguistics by participating in mental and physical activities that is in acceptance by others. Being given this notion it is not a surprise to see people using code switch when they notice there is a difficulty in decoding the message in English where they can still use their mother tongues such as Bahasa Melayu, Tamil and Cantonese or Mandarin as the alternative of communication, which is a more effective way of assimilating to the non English spoken community. This is the situation that we always see not only in schools, but also in a community where the people choose not to speak in English. (Lantolf’s, 2000, as cited in Kao, 2010), interpreted language as one of the symbolic (or psychological) mean of mediation in mental activities in regards with Vygotsky’s sociocultural theories where he believed that individuals express and govern their physical and mental behavior by using psychological tools. This kind of situation has given an option to the second language learners, where they have found a space for not using or practice the second language that is supposed to be spoken as a practice. In second language learning, this is considered as a barrier to acquisition.

Jacqueline (2010) stated that the beliefs on other cultures and language determined by the social or cultural environment where an individual lived have a substantial influence on second language acquisition. Therefore, the attitude of a second language learner is somehow affected by the treatment and perception given or set in the community itself. According to Vygotsky (1978 as cited in Lantolf, 2000; Turuk, 2008) sociocultural environment provides the child with various tasks and demands and occupies them in his world through the tools.
Vygotsky (1978 as cited in Wertsch, 1985; Turuk 2008) states that the child acquires knowledge through connections and exchanges of information with the community as the first step (interpsychological plane), and then adapts the knowledge as to compliment his personal value to it (intrapsychological plane). According to Vygotsky, the process is not just a reproduction, but also a transformation of what had been learnt via communication, into personal values. The ideas show that sociocultural environment shapes the learners’ way of thinking and processing information that eventually will be part of the learners’ identity. Our English language learners are actually facing difficulties in learning effectively as the surrounding is not supporting enough, which will lead to several barriers in grasping the language.

**CULTURAL DIVERSITY AND SLA**

Smith et.al (2014) in their research on the Role of Social Capital in Language Acquisition during Study Abroad found that students who established network between themselves with the culture and values claimed that they attained the higher levels of language improvement. He claimed that this research has dealt with several issues such as language use, proficiency development and language socialization (Badstubner&Ecke, 2009; Mendelson, 2004 & Fraser, 2020;Campbell, 1996 as cited in Smith, 2014). This learning environment is in line with Vygotsky’s Activity Theory in which he claimed that social communication activities promotes and urges learners to think as well as speak in the target language that will bridge the speakers to understanding. With that stance, it is believed that human’s learning is an endless communal communication of thoughts, behavioral and ecological factors (Aimin, 2013). Studying and living in an English spoken country requires them to assimilate the language, the difference of cultures and values that gradually drives them towards improvement of the language. As cited by Segalowitz (n.d) in her research on Spanish students, “several studies which compare the language learning of students in study abroad contexts with those in the regular classroom have demonstrated increased gains in vocabulary (DeKeyser 1986, 1991; Lennon 1990; Milton & Meara 1995; Walsh 1994), in the acquisition of sociolinguistic features of the language (Lafford 1995; Marriott 1995; Regan 1995), and in expression of oral fluency (Freed 1995b, Lafford 1995).”. Even though language can be learned via listening to the media, or reading the English written materials, speaking skills will not develop until one tries to speak or use the language verbally.
Kao (2010) stated that learners will be lead to a more effective learning experience and are encouraged to learn or understand more when they are interacting with people with different levels of skills or knowledge. (Duff & Uchida, 1997, p. 452 as cited by Gan, 2010) presented an analysis of data that suggested learners’ psychological relation to the English language learning process depends in large measure upon the social, institutional, and interpersonal contexts “in which individuals find themselves, the purposes for their being there, and their personal biographies”. (Norton 2000 as cited in Rajadurai, 2009) stated that “When language learners speak, they are not only exchanging information with target language speakers, but they are constantly organizing and reorganizing a sense of who they are and how they relate to the social world”. Speaking of purposes, by living abroad, learners will be more aware of the purpose of using English as a medium of communication as compared to using it in home country, where switching to the mother tongues is permissible and they will try to get along with the society where they will have to adjust themselves in accordance to the communication style of the society.

Aimin (2013) in her article stated the following:

“Vygotsky captured the interconnection established by internalization in his general law of genetic development: Every psychological function appears twice, first between people on the inter-psychological plane and then within the individual on the intra-psychological plane [27]. Internalization is a negotiated process that reorganizes the relationship of the individual to her or his social environment and generally carries it into future performance. Internalization accounts for the organic connection between social communication and mental activity and is the mechanism through which we gain control over our brains, the biological organ of thinking. Imitation is regarded as the best approach by which internalization is realized. However, Imitation here is different from the concept in behaviorism which only copies or imitates others’ behaviors passively but involves goal directed cognitive activities that can result in the creative and active transformations from inter-psychological plane to intra-psychological plane. Just as Vygotsky states that imitation is —the source of instruction’s influence on developmentl [27].” (p. 163)
Other than communicating using the targeted language, learners will tend to learn and imitate the usage of the language as being spoken by the native speakers as a mean of assimilating to the society. Atkinson (2002) as cited by Yamat (2010) stated that the fundamental concern of SLA should be the study of social action, as most studies that focus on a social understanding would emphasis on social and cultural influence on SLA, for the communication activity is closely inclined to cultural elements. Therefore, it is believed that children or learners of second language acquire the new language through involvement and action in living their daily lives Pennycook (1994). The learners who live abroad will eventually complete the stage of amalgamation to the society through out their daily interaction and social life. Lantolf and Appel (1994) as cited in Moussa (n.d) stated that Vygotsky claimed that in an attempt to control the surrounding, human developed tools that permit them to cooperate with other individuals in order to reach their goals. The ‘tools’ that developed by individuals who are trying to assimilate is the language that is widely spoken by the society they live in. From the discussed studies, it shows that language learners will experience a more effective learning by communicating using the targeted language when they see the purpose, functions and trying to deliver message they are trying to convey.

BARRIERS IN LOCAL SETTING TO SECOND LANGUAGE ACQUISITION

Language learning requires a contributive environment in which English not only to be spoken in the classroom, but also to be the medium of communication outside the classroom setting. For example, in Malaysian educational setting, English subject is being taught twice a week, that equals to 3 hours weekly. According to Long (1983) in the Interaction Hypothesis theory about the role of interaction in the second language learning, modified input that is created within interaction can be facilitating in explaining linguistic forms that learners found difficult to understand; therefore, a second language can be acquired by the learners through in-classroom interaction (Ellis, 1999; Ellis, 1998; Ellis, 1995; Long, 2006 and Ellis, 1997 as cited by Moussa, n.d). However, in English spoken country, in-classroom interaction might be sufficient for learners to practice the language, but not in a non-English spoken country like Malaysia. Bahasa Melayu is widely spoken especially in a Malay community. In fact, Bahasa Melayu is the official language of Malaysia. Therefore language option exists when the learners try to interact in the local community.
In a research done by Gan (2010) has proven a clear cut on the difference in oral English fluency between those who studied locally and those who studied abroad. A successful student who had an early education in local school realized that her classmates who had experience studying abroad were so fluent in English that they sound like a native speaker. He therefore concluded that one could achieve native-like speaking skills when they are in English speaking setting.

Figure 1. How output contributes to language acquisition indirectly


Krashen (2009) claimed that some scholars recommended that participation in conversation helps language acquisition (see fig. 1). It is a very good way to obtain input as a stimulator to language acquisition that takes place throughout the conversation, where the output will be the outcome that can gauge the competency level of a learner. He believes that the more learner talks, the more people will talk to them. (p. 60).

Another barrier that can impair the learning of second language is the belief of the society itself. Rajadurai (2009) in her case study pertaining Malay English learners’ experience in the Malay community found that the practice of English is hindered by the community ideologies and practices that do not encourage them to speak the language. They received negative perception every time they used English and were seen as impolite, boastful, insensitive and supercilious. This situation happened when they are back in their hometown where most people prioritize the identity background, loyalty and traditional values. Other than that, code switching is also another factor that impair the practice of English among learners as other races such as Chinese and Indian tend to switch to Bahasa Melayu whenever they speak to the Malays, unless the Malays first shown them that they are capable and comfortable speaking in English with them. The situation would somehow defeat the purpose of learning English where learners should be practicing the language in order for them to improve or master the skill.
According to Aimin (2013), she stated that, “Skinner holds that language is a verbal behavior, that is, that the production and comprehension of what is uttered is automatic. Thus, language learners can be made to automatically produce and comprehend language. For behaviorists, no learning occurs if there is no observable change in behavior. They mainly choose to ignore inaccessible mental processes and focus on observable behavior”.

This is another reason why in-classroom interaction in English learning alone is not enough as there is no conducive environment, that is English speaking setting for them to freely speak the language without being judged, misunderstood and rejected. Second language learning can be improved when learners are set in an appropriate environment where they are free to interact the language with other people as (Anton, 1999; Lantolf, 1994; Appel and Lantolf, 1994 as cited in Moussa, n.d) suggested that socio-cultural theory of mind is about the ways that language functions as a mediation tool in the learning process. Vygotsky’s theory strengthens that when humans are trying to communicate, they recruit symbols or signs as tools in order to mediate learning and therefore humans are viewed as social mediating beings (Lantolf, 2006; Mitchell and Myles, 2004; Lantolf and Appel, 1994; Appel and Lantolf, 1994 as cited in Moussa, n.d).

CONCLUSION

With current educational system, our National Education Philosophy to create well-equipped and holistic individual will reach its objectives. However, to bring the individuals towards globalization, it takes more than just the fours skills – reading, writing, listening and speaking; it takes the ability to do all the four skills in lingua franca, which is the language that is understood by the world - English. To acquire the second language, students need to be exposed to the daily use and the culture of the language, so the practicality of the language will be clear and therefore will slowly but surely developed to the level where they feel the need of using it in daily communication. Malaysian students who further their study abroad have the privilege to learn the language more effectively and naturally.
On the other hand, students who are receiving education in the local setting should too, be given the opportunity to experience a conducive English learning environment as to familiarize them with the language at any cost. Undeniably, English language is taught in schools since the earliest level of education, however the freedom provided to practice the language is still a big question. The significance of creating an English speaking environment is still vague in our system.

Teachers or lecturers, who teach other than English subject, should work together in promoting the use of the language, regardless of their field of studies by choosing English as a medium of communication both inside and outside classroom. Learning institutions should be the hub of education not only to learn skills and knowledge; it should also be the setting where learners are shaped towards globalization.

REFERENCES


ABSTRACT

The choice of design parameters in regression models is vital. The validity of these regression models are based on significant contribution of independent variables and suitability of goodness-of-fit tests. Hence, this paper employs a modelling approach in regression analysis which focuses on four phases in model-building procedures. Regression models examined include the multiple, polynomial, time series, logit and logistic regression. In this paper different goodness-of-fit tests are illustrated for different types of regression models.

Keywords: Modelling; Regression Models; Model-Building phases; Goodness-of-fit.

INTRODUCTION

Multiple regression analysis provides the analyst with such a variety of techniques that the primary problem is to decide exactly what form the regression equation (or regression models) will take, besides including which independent variables will be used. This typically comes after investigating different possibilities, a process known as model-building phases that had been described by Hocking (1976). Multiple regression analysis, a form of general linear modelling (Hair et al., 2010) is a statistical technique that can be used to analyze the relationship between a single dependent (criterion) variable and several independent (predictor) variables.
The objective of regression analysis is to predict a single dependent variable (DV) from the knowledge of one or more independent variables (IV)'s. In this paper, some of the regression models had been examined which includes the multiple linear, polynomial, time series and logistic regression models. These models can be different in the types of data used in the analysis. As stated in Nishi (1988), these models can also have their own methods in the process of the parameter estimates. The assessment of the fit of a model is a very important component in any modelling procedure. Goodness-of-fit tests try to evaluate how well model-based predicted outcomes coincide with the observed data. In the model building procedure the final phase is to determine the model’s goodness of fit. Unfortunately, there are no formal standards on how to evaluate the goodness-of-fit of models to data variables. As a result, there is considerable variability in the methods used and with frequent selection of choices that leads to the misinterpretation of the research findings (Roberts & Pashler, 2000).

MODEL BUILDING PROCEDURE

Step 1: All Possible Models

All possible models, N can be calculated by using the formula:

i) Without Interactions

\[ N = \sum_{j=1}^{q} \binom{q}{j} \]

ii) With Interactions

\[ N = \sum_{j=1}^{q} j \binom{q}{j} \]

Where N is the number of possible models generated and q is the number of IV’s excluding the dummy variable. All regression models will undergo the step in determining the number of possible models based on the number of IV’s.
Step 2: Selected Models

Multicollinearity is the intercorrelation of IV. The higher correlation coefficient will increase the standard error of the beta coefficients and produce an assessment of the unique role of each independent resulting in difficult or impossible output. Multicollinearity exists if |Correlation Coefficient| ≥ 0.95. The Zainodin-Noraini multicollinearity remedial procedures had been applied and details are explained in Noraini et al. (2011) and Zainodin et al. (2011). The Multicollinearity test is not applicable to the time-series data due to the data characteristics. Next, the coefficient test should be carried out as an elimination procedure of insignificant variables. To justify the removal of the insignificant variables, the Wald Test (Ramanathan, 2002) should be applied to the possible models upon the execution of all the elimination procedures of insignificant variables. Backward elimination procedure (Noraini et al., 2008) has been implemented where all variables are entered and then the poorest predictor is eliminated. The process continues until all of the non-significant variables are removed as suggested in Freedman (1983). Usually by default, variables that are not significant are removed on each step of p-value larger than 0.05.

Step 3: Best Models

Identification of the best model should be based on Eight Selection Criteria (8SC) as shown by Noraini et al., (2011). The objective is to determine a model with the lowest value of a criterion statistic. The calculation of the criterion statistics will be based on the Sum of Square Error (SSE), number of resulting estimated parameters (k+1) and the sample size (n), as shown in Table 1.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIC</td>
<td>$\frac{SSE}{n} \phi \frac{1}{n}$</td>
</tr>
<tr>
<td>RICE</td>
<td>$\frac{SSE}{n} \left( 1 - \frac{2(k+1)}{n} \right)^{-1}$</td>
</tr>
<tr>
<td>FPE</td>
<td>$\frac{SSE}{n} \frac{n + k + 1}{n - (k + 1)}$</td>
</tr>
<tr>
<td>SCHWARZ</td>
<td>$\frac{SSE}{n} \left( \frac{1}{n} \right)^{\frac{1}{(k+1)}}$</td>
</tr>
<tr>
<td>GCV</td>
<td>$\frac{SSE}{n} \left( 1 - \frac{k+1}{n} \right)^{-2}$</td>
</tr>
<tr>
<td>SGMASQ</td>
<td>$\frac{SSE}{n} \left( 1 - \frac{k}{n} \right)^{-1}$</td>
</tr>
<tr>
<td>HQ</td>
<td>$\frac{SSE}{n} \left( \frac{\ln n}{\ln (n+1)} \right)^{\frac{1}{2}}$</td>
</tr>
<tr>
<td>SHIBATA</td>
<td>$\frac{SSE}{n} \frac{n + 2(k+1)}{n}$</td>
</tr>
</tbody>
</table>
The 8SC can only be carried out for the multiple linear, polynomial and the time series models. However, for the identification of the best model using logistic regression, the Modified Eight Selection Criteria (M8SC) should be used instead and the formula is shown in Table 2. The calculation of the criterion statistics will be based on the deviance statistics value, number of estimated parameters (k+1) including the constant term and the sample size (n). The deviance statistics value can be calculated as follows:

\[ G^2 = \text{deviance statistics} = -2 \sum_{i=1}^{n} \left[ Y_i \ln(\hat{\rho}_i) + (1 - Y_i) \ln(1 - \hat{\rho}_i) \right] \]

<table>
<thead>
<tr>
<th>AIC: ( \left( \frac{G^2}{n} \right) \frac{2((k+1))}{n} )</th>
<th>RICE: ( \left( \frac{G^2}{n} \right) \frac{1 - 2(k+1)}{n} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPE: ( \left( \frac{G^2}{n} \right) \frac{n + k + 1}{n - (k + 1)} )</td>
<td>SCHWARZ: ( \left( \frac{G^2}{n} \right) \frac{2(k+1)}{n} )</td>
</tr>
<tr>
<td>GCV: ( \left( \frac{G^2}{n} \right) \frac{n + 1}{n - (k + 1)} )</td>
<td>SGMASQ: ( \left( \frac{G^2}{n} \right) \frac{1 - k + 1}{n} )</td>
</tr>
<tr>
<td>HQ: ( \left( \frac{G^2}{n} \right) \frac{\ln n}{n} \frac{2(k+1)}{n} )</td>
<td>SHIBATA: ( \left( \frac{G^2}{n} \right) \frac{n + 2(k+1)}{n} )</td>
</tr>
</tbody>
</table>

Akaike Information Criterion (AIC) (Akaike, 1974) and Finite Prediction Error (FPE) (Akaike, 1969) were developed by Akaike. The Generalised Cross Validation (GCV) was developed by Golub et al. (1979) while the HQ criterion was suggested by Hannan and Quinn., 1979). The RICE criterion was discussed by Rice (1984) and the SCHWARZ criterion was discussed by Schwarz (1978). The SGMASQ was developed by Ramanathan, 2002) and the SHIBATA criterion was suggested by Shibata (1981).

**Step 4: Model’s Goodness of Fits**

The final phase of model building is obtained by applying the Goodness-of-Fit on the final best model. The goodness-of-fit of a model to data is evaluated in two different ways: 1) through the use of visual presentations methods which allows for visual comparison of similarities and differences between model predictions and observed data; and 2) through the use of numerical measures which provides summary measures of the overall accuracy of the predictions.
The numerical measures for goodness-of-fit comprised of the randomness test and normality test. Randomness test is to determine that the residuals are randomly distributed and normality test is to ensure that the normality assumptions are not violated. These tests can only be applied on linear multiple and polynomial models. For logistic regression models, two similar overall models goodness-of-fit tests, namely, Pearson and Deviance goodness-of-fit tests can be used. Hosmer and Lemeshow (1980) were the first to propose a goodness-of-fit test that can be used for logistic regression models with continuous predictors. They suggested using a Pearson-like chi-square statistic, but the groups are formed according to deciles of risk. In this way they solved the problem of categorizing, though it is well-known that this is at the cost of power. The Hosmer-Lemeshow goodness-of-fit test is one of the choices that can be applied. As an alternative, the Cox and Snell $R^2$ measure operates like $R^2$, with higher values of $R^2$ indicates a better model fit. However, this measure is limited in that it cannot reach the maximum value of 1, so Nagelkerke proposed a modification that had the range from 0 to 1. Hence, Nagelkerke's measure is more reliable to indicate the strength of the model fitness relationship.

**DISCUSSIONS**

Model building procedure provides a method for demonstrating predictions by using regression analysis. This procedure assists researcher to obtained quantitative predictions that can be used to explain the phenomena based on the data characteristics. Even though the main objective is the same but variety of tests involved must be correctly used. From this paper, the model building procedure can be divided into four major steps. This formal standard in model building is one of the most complete procedures to achieve the best model and to evaluate the quantitative goodness-of-fit of models to data, either visually or numerically. The usage of certain tests with its alternatives provides the best model which is in compliance with the model’s assumptions. The crucial step in this model building procedure is to measure the models’ goodness of fit. Variety of concept has been proposed especially in the determination of goodness of fit conclusion which includes examining residuals from the model, outlier detection, a global measure of “variance explained” ($R^2$), a global measure of “variance explained” that is adjusted for the number of parameters in a model (adjusted $R^2$), Chi-square goodness of fit tests and model validation via an outside data set or by splitting a data set.
CONCLUSIONS

The main point of the model-building procedures is to obtain the best model that is reliable for prediction. Goodness of fit tests can be the tools for this purpose. The selected IV’s included in the model will give the researcher the best contributing factors in prediction, as long as the best model fits well, it can be considered as a good estimator. This model can be verified further by using other tools, for example, Mean Squared Error (or Deviation) (MSE) or Mean Square Percentage Error (MAPE). The value obtained can be used as the supporting evidence in the validation steps.

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ABSTRACT
Gender differences have always been a subject of interest for human beings. Such interest in language is not an exception. However, linguists prefer the term gender rather than “sex” because sex has to do with biological distinction; it is “a matter of genes, gonads and hormones” (Talbot 1998: 7). The term gender was also chosen as a neutral, an indiscriminating one (see Nevalainen 2003: 110, Curzan 2004). In contrast to the term sex “gender” refers to a linguistic construct on the one side and to the social construct on the other side. Gender as a linguistic construct relates to a gender system of language which is represented by e.g. the personal pronouns he, she, it or lexical items that “refer to men and women, as well as girls and boys” and which “retain gender semantically in a natural gender system” (Curzan 2004). Language as a social construct relates to the roles of males and females in society. The attitudes towards men and women are reflected in the language. Otherwise, we can observe gender differences analysing certain language patterns. It is assumed that language not only reflects gender division, but also creates and sustains it (Coates 1993: 4). In this paper I will be looking primarily at the impact of gender as a social variable on the English language. I will review the language change in the past, and the Case of Early Modern Women.

Keywords: The Corpus of Early English Correspondence (CEEC), Labovian Theory, Multiple Negation.
INTRODUCTION

According to this article, ‘Gender and Language Change: The Case of Early Modern Women’ by Suzanne Gregoire, men tend to practice vernacular language form since they think that vernacular language is related to masculinity. On the contrary, women use less vernacular language and accept the standard language as the ‘correct’ language. They prefer to use more standard language not only to become a good role model in speech for their children but to show empathy. Since women are more sensitive to high status than men, they practice standard language more to be respected by others. Indeed, men relate the vernacular forms with authority. They show their sense of authority and masculinity by just using the vernacular language.

This article is to explore on how have sociolinguists arrived at these theories about women’s central role in language change and how can they be applied to a historical study of the role played by women in the standardization of the English language during the early modern period. Section 1 introduces the subject of gender and language variation. This section includes topics on gender as sociolinguistic variable together with gender and linguistic change. Based on the article, Eckert and McConnell-Ginet have summed up the varied positions in stating that “women’s language has been said to reflect their conservatism, prestige consciousness, upward mobility, insecurity, deference, nurture, emotional expressivity, connectedness, sensitivity to others, solidarity. And men’s language is heard as evincing their toughness, lack of affect, competitiveness, independence, competence, hierarchy, control (qtd. in Wodak & Benke 127)”.

Personally, I do agree with Eckert and McConnell-Ginet’s statement. Women are traditional creatures and full of self-doubt. In order to be prominent, they regard standard language as the best language for them to acquire. They are also mothers and caretakers of the young generation so their language is served as a model for the children’s speech. In order to ensure that the children grow with a noble and proper speech, women as mothers need to prepare themselves with a good language. In contrast, men practice more vernacular language since they are not serving their language forms to the children. Section 2 outlines the major sociolinguistics paradigms of gender and language change. This section includes the sociolinguistics methodology used such as The Standard Paradigm, The Sex/Prestige Pattern and The Labovian Tradition. The Standard Paradigm examines the relationship between linguistic variation and social class and reveals clear social stratification in language, giving rise to the related concepts of prestige and stigma.
Based on my further reading, prestige is associated with the language used by the social
group from the highest standing. As for the stigma, the standard dialect is more ‘correct’ than others.
Non-standard varieties are often referred to as the vernacular forms of language which are not fa-
voured by women. This is due to the fact that women’s language is served as the model for the chil-
dren’s speech.

LABOVIAN THEORY

Based on the Labovian Tradition, William Labov states that language change is either con-
scious or unconscious, unconscious being when people change their language without noticing, and
conscious being when people realise they are changing the way they speak, and actively encourage
it. An investigation has been done to look at the conscious speech change and uses the example of
Labov’s New York Department Store study with the involvement of Prestige.

Prestige can be separated into ‘overt prestige’ and ‘covert prestige’. Both are used when
changing speech to gain prestige, which refers to appearing to have a high reputation, standing and
success, but do so in different ways. If someone uses ‘overt prestige’ they put on an accent that is
generally widely recognized as being used but the ‘culturally dominant group’.

In my personal understanding, covert prestige means to put on an accent to show member-
ship to an ‘exclusive community’ in the area, rather than to fit with the ‘dominant culture group’. Fur-
thermore, using covert prestige would therefore be putting on a more ‘street cred’ accent and even
though the ‘dominant culture group’ generally sees it as being inferior, using language fitting with the
local community would lead to earning respect with those also in the community. Section 3 considers
the application of these modern sociolinguistic ‘universals’ to specific language changes taking place
during the early modern period.

This section involves Historical Sociolinguistics and Gender, The Corpus of Early English
Correspondence (CEEC), the results and the conclusion of the article. The Historical Sociolinguistics
research has produced strong evidence for the influential role of women in language variation and
change in present-day speech communities, however, the role of women in the historical development
of the English language is less clear.
THE CORPUS OF EARLY ENGLISH CORRESPONDENCE (CEEC)

The Corpus of Early English Correspondence (CEEC) contains a selection of letters from the bigger corpus. Precisely, the word ‘corpus’ refers to a collection of written texts, especially the entire works of a particular author or a body of writing on a particular subject. In this article, the corpus covers the period between 1417-1681. It contains 6,000 letters written by nearly 800 individuals (Nevalainen & Raumolin-Brunberg 9). Through data drawn from the corpus, Nevalainen and Raumolin-Brunberg examine the supralocalization of a number of grammatical features that became part of Standard English during the period. Their study addresses the role of multiple social variables in language change, one of which is gender. The term ‘gender’ refers to both male and female. It is claimed that women are more linguistically polite than men are. Do you agree with this statement? As for me, I am totally agree for some good reasons. Based on the article, which I have reviewed, there is a statement saying ‘A woman’s place is in the home’. The saying refers the women’s role as guardian of society’s values. Women regard standard language as a proper language. Hence, they tend to use the standard language and practice less vernacular forms due to prepare themselves with respectable and proper language for the children to acquire. This is one of the significant reasons why women’s language is more polite than men. Women operate as subordinate group in the social hierarchy. As the secondary group, they must be polite to the superior group, which are the men.

CONCLUSION

Based on the article, the result suggests that fourteen changes are analyzed and the general pattern that emerges is one in which women are found to lead the process of linguistic change in the majority of cases. In 8 out of 14 examples, women adopt new language variants earlier than men and in 3 cases an initial male advantage switches to female advantage. However, in 3 particular cases men score ahead of women. The three changes led by women are discussed in the study which include the generalization of the object pronoun form you in the subject function, the diffusion of the short possessive determiners my and thy, and the diffusion of the third-person singular suffix -(e) s. In contrast, one change led by men is also provided such as the replacement of multiple negation with single negation. In most logics and some languages, double negatives cancel one another and produce an affirmative sense, in other languages, doubled negatives intensify the negation.
One example of multiple negation is ‘He don’t want none’. Based on my further readings on multiple negation, in New York City, the use of multiple negation by Detroit African Americans is stratified by social class. Lower-middle class men practice more multiple negation compared to the upper middle-class men. The result of the article tries to indicate that women in certain points lead language change. The data reveals a clear gender differentiation by the sixteenth century, with women leading the change.

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ANALYSIS OF REDUCING INTER-SYMBOL INTERFERENCE IN MIMO-OFDM SYSTEM

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**ABSTRACT**

The propose of this studies is to eliminate the Inter-Symbol Interference (ISI) or known as Inter-Channel Interference (ICI) from Multiple Input Multiple Output Orthogonal Frequency Division Multiplexing (MIMO-OFDM) system. Orthogonal Frequency Division Multiplexing (OFDM) is a modulation scheme that is transmitting data in orthogonal and suited for high-data-rate transmission in delay-dispersive environments. The greatest ways to transmit the data using wireless system is using the MIMO principle. MIMO is the use of multiple antennas at both the transmitter and receiver to improve communication performance. In transmit the data using wireless, the consideration that must been is fast, reliable, less noise and accurate. The greatest technology in the universe now that can fulfill of this requirements is the MIMO technology and of course is have some a little interference during the transmitting the data between transmitter and receiver. The interfere between this transceiver and receiver is called as ICI. For this study, we used multipath Rayleigh Fading channel using MATLAB to analyze the interfere in MIMO transmission. A novel ICI cancellation scheme for OFDM wireless communication system is proposed. By equivalently representing the OFDM system with Synchronous Code-division Multiple Access (SCDMA) model, the scheme for the multiple access interference (MAI) cancellation in the SCDMA model can be directly applied to the ICI cancellation in the OFDM system. This study showed a method of reducing noise elimination to provide a great service provider to the subscriber or user.

**Keywords:** Orthogonal Frequency Division Multiplexing, Noise, Inter-channel-interference
INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) modulation is one of multi-carrier technique (MCM) that send signals via multiple carriers. These carriers have different frequencies and the carriers are orthogonal to each other. Orthogonal frequency division multiplexing techniques have been used in wired and wireless communications, such as the asymmetric digital subscriber line (ADSL) and the IEEE 802.11 standard. MIMO systems are systems with the multiple of transmitter and receiver that take more than one transmitter and receiver. Originally suggested at 1990s in Winter with attracted great attention through theoretical investigations ([Foschini and Gans 1998] and [Telatar 1999]). Since that time, research on these system has explode to the world of communication and the practical system based on MIMO has been evolution. ISI is an reducing well known to degrade performance of MIMO-OFDM transmissions. Its coming from carrier frequency and the Doppler spread due to channel time-variation. Literature reports several models of ICI due to each kind of impairment.

OBJECTIVE

This research study intends to plug the research gap and will demonstrate the development of the techniques to estimate the ICI in MIMO-OFDM. The objective of this project is to observe the Space-Time-Frequency (STF) Codes to achieve a maximum diversity order against Rayleigh fading channel. The signal quality of system must been improve first with cyclic prefix method and to evaluate the performance and development of Space-Time-Frequency Codes for OFDM-QPSK modulation techniques by using Cyclic Code decoder and Linear Maximum Likelihood Estimation Technique. Besides that, this project is to evaluate the performance and terminate the inter-carrier interference (ICI) in MIMO OFDM system. To measure the performance of this system, the Bit Error Rate (BER) vs Signal to Noise Ratio (SNR) performance graph must been studied.

The Designation of MIMO-OFDM System

Scope of Works

From the research the systems that need to build have to be depends on the surrounding, technology and also production mechanization. The method to generate this system used the electronic system which combines all the function in one system using the PIC to operate the whole system.
The main focus of this research is to studies each of the element in the transmitter and receiver of MIMO-OFDM that has been created or design based on the related books and research paper. The massage will been put in the system to analyze the input. The type of this input is put in binary such as 1010. The signal will through the block codes. The function of the block code is to encode the data into blocks. In digital transmission, the important part before transmit data is to encode the message into blocks because in digital only can read the binary type of signal only. After the signal through the block codes, the data was modulate using the quadrature phase shift keying (QPSK) that is most suitable method of modulation because the research is via free space and wireless with the high speed transmission. Function of QPSK is to sends information by altering the phase of the carrier wave and the formula for this modulated technique is in quarter. Before the signal go to the MIMO system, the signal must through the space-time frequency block codes (STFBC) to modulate the signal. The consideration that have been taken is the free space that is wireless, time taken and the frequency of the free space that been use to transmit data.

In receiver, the data was previously back the step that have been use in transmitter. Signal that been receive has been inverse transform back in order to get the output is same as a input. In the end of this transmitter, the signal was be decode back using two(2) decoder that is linear maximum likelihood decoder and space time frequency decoding. The mainly interfere on this system is between the transmitter and receiver that called as ISI.
The method that been purpose for this proposal is using the cyclic prefix to reduce the ISI so that the signal is less of complexity and ready to transfer fast and more simply. The block diagram that was design to evaluate the performance and to analysis the signal propagation shown in Figure 1. For this analysis, the MATLAB (matrix laboratory) are use to evaluate and simulate the performance of the system. With this software, the system can creates the user interface, interfacing with other program such as C, C++, Java and Fortan, implementation of algorithms, plotting of function and data and allow matrix manipulation. Although, for allowing to access the symbolic computing capabilities, intended primarily for numerical computing can also with the MATLAB software.

The Implementation of ICI Reduction in MIMO-OFDM System

Flow Chart

![Flow Chart](image)

Figure 2: Flow Chart of the MATLAB Simulation
Assume that the message \( k = 4 \) and the code word \( n = 7 \) i.e. \((7, 4)\). The input signal is set to be random input signal in order to generate more than one message to observe the performance of OFDM-QPSK modulation in diversity scheme. At the time diversity (time interleaving) stage, the input signal will split into four signals and parallel with each other. Then the four signals are encode by using cyclic block codes, and this code change from four bits to seven codeword. QPSK modulation techniques with four different frequency carriers modulate the signals into frequency spectrum. The modulated signals are then convert into time domain using Inverse Fast Fourier Transform (IFFT). After that, these signals will be transmitted simultaneously using four antennas. Afterward, these signals are add with noise (Rayleigh fading channel) in the air interference. The flow of the system is shown in Figure 2.

At the receiver stage, the receiver will receive transmitted signals using three antennas and decide the three best signals which give highest SNR and lowest noise using selection method. The FFT is applied to each signal to transforming the time domain signals into frequency spectrum signals. At the demodulator, the FFT signals will demodulate and giving the seven codeword. The codeword will check and correct by using forward error correction (FEC). After that the seven codeword will decode by cyclic block codes to produce the four bits messages and time Deinterleaving is apply to have an output message. Finally the output message will compare with original message to get the value of BER.

**Modulation Technique**

In QPSK and Bipolar Phase Shift Keying (BPSK), the input sequence is encoded in the absolute position in the constellation. In \( \pi/4 \) QPSK, the input sequence is encoded by the changes in the amplitude and direction of the phase shift and not in the absolute position in the constellation. \( \pi/4 \) QPSK uses two QPSK constellations offset by \( \pi/4 \). Signaling elements are selected in turn from the two QPSK constellations. Transitions must occur from one constellation to the other one. This ensures that there will always be a phase change for each symbol. Therefore, \( \pi/4 \) QPSK can be no coherently demodulated, which simplifies the design of the demodulator. Phase Shift Keying is a form of phase modulation, which is able by the use of discrete number of states. QPSK refers to PSK with 4 states as shown in Figure 3.
Figure 3 Constellation diagram for QPSK with Gray coding

Analysis the Results of MIMO-OFDM Transmission

Random input (binary input)

For this simulation, random input are use to test the system. For real system such as voice and packets, the input must be generate first or convert to polynomial that is binary and from this form it can be simulate in digital transmission, illustrated in Figure 4.

Figure 4: Random Input
Multipath Raleigh Fading

The OFDM signals that been transmitted through the channel using four antennas are added with noise. On this stage, the time domain signals shown in Figure 5 for OFDM signals are added with noise. Rayleigh fading is added into the system. One antenna produced two output that is for time and frequency signal and equal 8 total of graphs.

At the receiver stage, three antennas as illustrated in Figure 6 received transmitted signals and decide to choose on between the four transmitted signals, which give three highest SNR and lowest noise using selection method. The Fast Fourier Transform (FFT) is applied to each signal to transforming the time domain signals into frequency spectrum signals. The demodulator will demodulate the signals into digital signal and giving the seven code word.

Figure 5: QPSK Modulated Signals adding with noise known as Multipath Raleigh Fading

QPSK receive Signals 1 After FFT

At the receiver stage, three antennas as illustrated in Figure 6 received transmitted signals and decide to choose on between the four transmitted signals, which give three highest SNR and lowest noise using selection method. The Fast Fourier Transform (FFT) is applied to each signal to transforming the time domain signals into frequency spectrum signals. The demodulator will demodulate the signals into digital signal and giving the seven code word.

Figure 6: QPSK receive Signals 1 After FFT
Sign to Noise Ratio vs Bit Error Rate (SNR vs BER)

Figure 7 illustrates simulation result in term of BER versus SNR graph for signal with ISI and without ISI with OFDM-QPSK modulation techniques. The red lines in the Figure 7 are for signal without ISI while the green lines are for without ISI.

![Graph showing BER vs SNR for signal with and without ISI](image)

Figure 7: Modulated signal with ISI and non-ISI

As shown in the Table 1 and 2 are the data taken from Figure 7. It can be see that with without ISI gives lower BER than with ISI in both modulation techniques. It can conclude be concluded that without ISI the system gave the best signal than with ISI and OFDM-QPSK modulation techniques suitable to be use for MIMO-OFDM modulation techniques.

<table>
<thead>
<tr>
<th>SNR</th>
<th>BER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1x (10^{-1})</td>
</tr>
<tr>
<td>10</td>
<td>1x (10^{-2})</td>
</tr>
<tr>
<td>15</td>
<td>1x (10^{-6})</td>
</tr>
</tbody>
</table>

Table 1: Signal with ISI

<table>
<thead>
<tr>
<th>SNR</th>
<th>BER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2x (10^{-1})</td>
</tr>
<tr>
<td>10</td>
<td>2.2x (10^{-2})</td>
</tr>
<tr>
<td>15</td>
<td>8.2x (10^{-6})</td>
</tr>
</tbody>
</table>

Table 2: Signal without ISI
CONCLUSION

This research studies had produced new development of MIMO-OFDM system. New technique or idea will be proposed, tested and applied to the analysis and the design of the MIMO system. From the STF aspect, the maximum of diversity order against Raleigh Fading Channel observed that the performance of time, bandwidth and frequency on the MIMO system. The quality of the signal has improved in order to reduce the complexity of the signal using cyclic prefix method. The cyclic prefix specially created to eliminate the interfere during the transmitting data in wireless system. Besides that, the performance of STFC for the QPSK modulated technique had evaluated using the cyclic code decoder and linear maximum likelihood estimation technique. The last stage of the project came out with the system with the less of fully eliminating the interfere between the transmitter and receiver. The BER vs SNR performance graph been studied in order to analyze the performance of the system before eliminate the ICI and after the ICI had removed.

REFERENCES
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