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A Novel Approach on Effective Implication of Object Oriented Based Software

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ABSTRACT: Majority of software and IT organizations have major difficulty in measuring organizational efficiency and effectiveness, despite a quaint array of proposed and sometimes used metrics. Effectiveness is an essential software quality which is useless if this software is not available in initial stage in the development life cycle.

In case of object oriented design it becomes more necessary. Estimating effectiveness of object oriented design near the beginning in the development life cycle, mainly at design phase; importantly reduce the development cost and rework, and simultaneously assists the software designers and developers for delivering high quality maintainable software within time and budget. In respect of Effectiveness, developed model estimates the effectiveness of class diagrams.

The goal of this research work is to promote researchers and developers for inclusion of the effectiveness quantification model to access and quantify software effectiveness quality factor at design time. Lastly the developed models have been validated using experimental tryout.

KEYWORDS- Effectiveness, Testability, Object Oriented Design, Software Quality Model, Effort Estimation, Effectiveness Implication, Software Design.

I. INTRODUCTION

This Software development processes mainly focus on reducing errors, finding and correcting software faults that does occur, and support to deliver high quality software within precise time and precise resources. However, the description of different characteristics that contribute to the concept of “quality” is not enough on its own in order to assure quality in practice. The overall purpose of the software is to deliver quality oriented software that is effective in operation, easily approachable to user within specified time and given budget because delivering quality software is no longer an advantage. The proposed study to evaluate software effectiveness by using the concept of software quality estimation during the initial time in development life cycle. Here research is needed to develop a structured scientific approach to ensure that software is stable, effective and high quality.

Generally, the process of software engineering consists of 4 stages: **Analysis, Design, Implementation and Support**. One of the subjects related to software engineering is software measurement. Software measurement has become essential to good software engineering. Measurement is the process by which numbers or symbols are assigned to attributes of entities in the real world in such a way as to describe them according to clearly defined rules. Many of the best software developers measure characteristics of the software to get some sense of whether the requirements are consistent and complete, whether the design has high quality, and whether the code is ready for test. Effective managers of project measure attributes of process and product to be able to tell when the software will be ready for delivery and whether the budget will be exceeded. Software measurement is not a key stream topic within software engineering. Rather it is a diverse collection of fringe topics (generally referred to as software metrics) that range from models for predicting software project costs at the specification stage to measure program structure.

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Fig 1: Effectiveness Estimation Framework: Design Phase Perspective

Fig. 1 Effectiveness Implication Framework: Design Phase

II. EFFECTIVENESS FACTOR

Effectiveness is one of the most essential attribute of software quality for delivering high quality software. It is also an important quality factor to testability estimation of object oriented software at an early phase of software development life cycle. Design time is most appropriate phase to estimate quality of software, because this phase is the first step towards problem domain to solution domain. Software quality is still a elusive and multifaceted concept ,which mean different things to different users, typically the way we measure quality depends on the viewpoint we take.

The overall purpose of the software is to deliver quality oriented software that is effective in operation, easily approachable to user within specified time and given budget because delivering quality software is no longer an advantage, but a required factor. The proposed study to evaluate software effectiveness by using the concept of software quality estimation during the initial time in development life cycle. Here research is needed to develop a structured scientific approach to ensure that software is stable, effective and high quality.

a. Correlations among Quality Factor, OOD Properties and OOD Metrics

The figure, describes the quantification process of effectiveness model in order to establish a multivariate model for effectiveness and OOD constructs. The values of these metrics can be easily identified by class diagram metrics. This metrics will play the role of independent variables while effectiveness will be taken as dependent variable. The quantifiable assessment of effectiveness is very helpful to achieve testability index of software design for quality product within time and given budget.[6]

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Proposed framework involves the following steps:

1. Identification of object oriented design metrics that influence effectiveness.
2. Identification of factors of object oriented properties.
3. Mapping of OOD Metrics, OOD Properties, and Quality Factor.

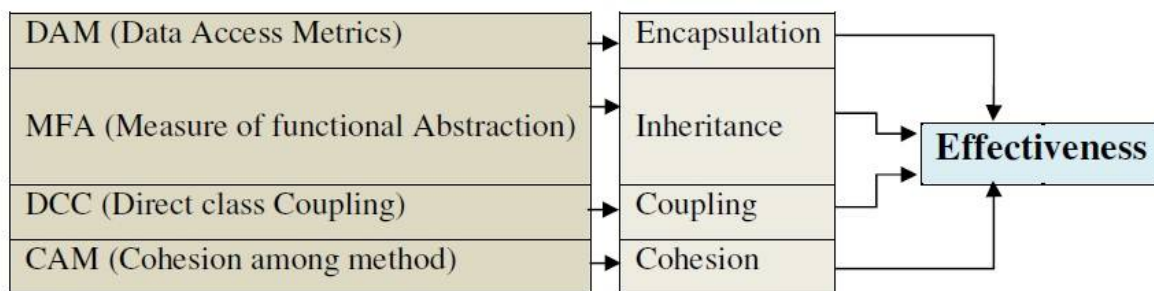


Figure 2. Effectiveness Quantification Framework of Object Oriented Design.

Correlation among effectiveness factor and object oriented design metrics has been established and shown in figure-1. In order to establish a mapping between object oriented design properties and quality factor, the influence of object oriented metrics are being examined with respect to effectiveness quantification model. It was observed that each OOD metrics affect certain quality factor. As per the values of selected independent variables, namely DAM (Data Access Metrics), MFA (Measure of functional Abstraction), DCC (Direct class Coupling), CAM (Cohesion among method), the values of dependent variable 'Y' can be found out by using the '*Effectiveness Quantification Model of Object oriented design*'[1][2]

b. MODEL DEVELOPMENT

Implication of class diagram's Effectiveness is prerequisite for the accurate effectiveness Implication. For this reason prior to developing EEM^{OOD}, the study has developed models for Effectiveness. In order to set up the models subsequent multivariate linear model (1) has selected.

$$Y = \mu + \beta_1 * X_1 + \beta_2 * X_2 + \dots + \beta_n * X_n + \epsilon \quad (1)$$

Where,

Y is dependent variables.

X1, X2... Xn are independent variables

$\beta_1, \beta_2 \dots \beta_n$ are the coefficients.

ϵ is error term

μ is the intercept.

II. TESTABILITY QUANTIFICATION FRAMEWORK

A comprehensive survey and analysis of relevant literature reveals feasibility of developing a testability quantification framework at design phase. Taking into account the need and significance of estimating testability in design time, a prescriptive; testability quantification framework is hereby proposed in fig. The essential and desirable features have been identified and a commonly accepted set of testability factors have also proposed that can directly or indirectly affect testability and make it easy to calculate testability index values for project ranking. The proposed framework consists eight phases including a common phase of "Design Review" and an input phase namely "Generalize Object Oriented Design (HLD/LLD)" a brief description of the framework is given as follows: [5]

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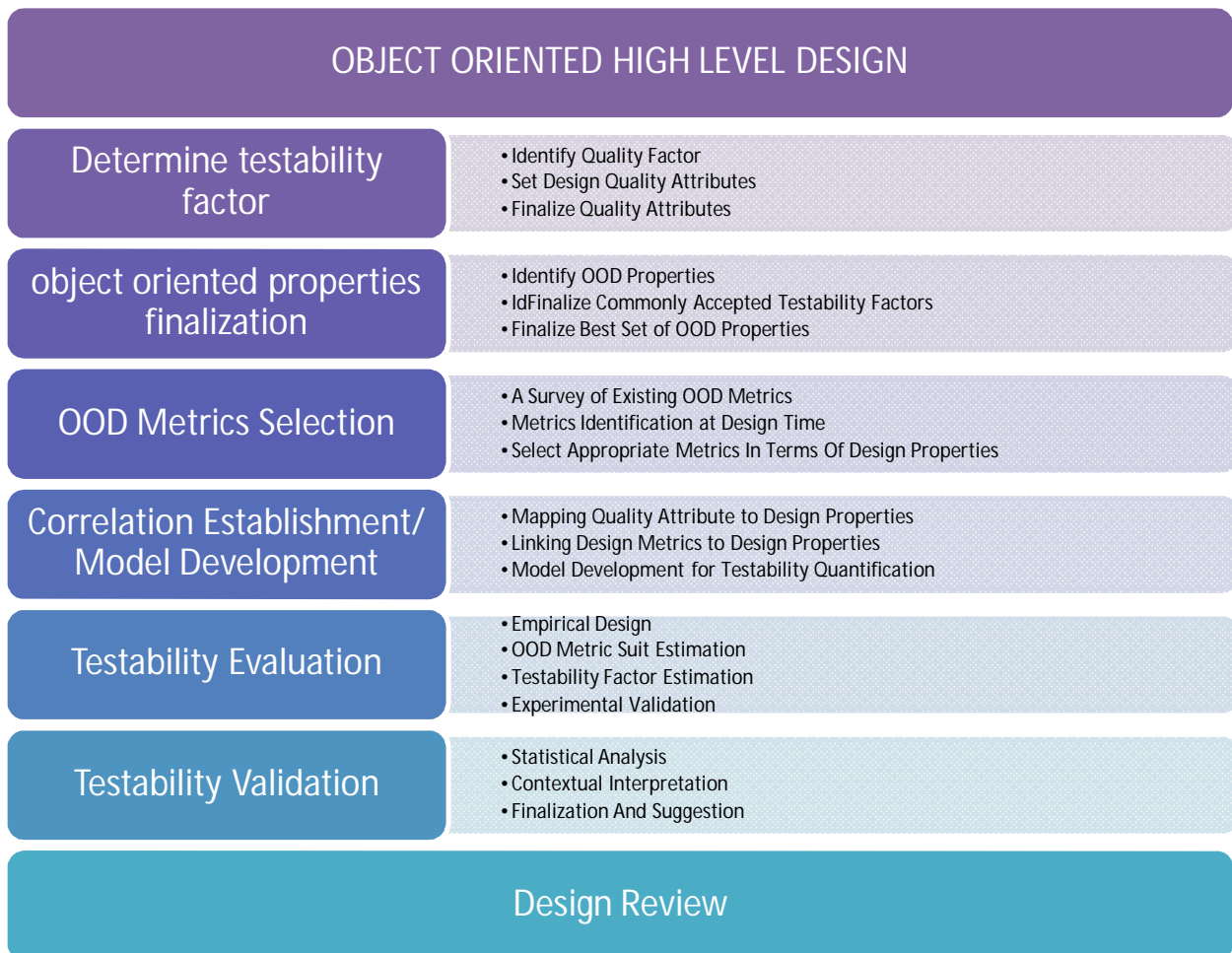


Fig.3 Layout of Object Oriented High Level Design

III. EFFECTIVENESS IMPLICATION MODEL

In order to set up an Effectiveness implication model of object oriented class diagram, metrics listed in [4] will play the role of independent variables while Effectiveness will be taken as dependent variable. The data used for developing Effectiveness model is taken from [3]. The correlation among Effectiveness Factors and Object Oriented Characteristics has been established as depicted in equation 1. Using SPSS, values of coefficient are calculated and Effectiveness model is originated as below:

$$\text{Effectiveness} = a_1 + a_2 \times \text{Encapsulation} + a_3 \times \text{Inheritance} + a_4 \times \text{Coupling} + a_5 \times \text{Hierarchies} \quad (1)$$

Where,

$a_1 = -4.081$, $a_2 = 4.645$, $a_3 = 11.996$, $a_4 = 2.701$ and $a_5 = -0.506$



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III. EMPIRICAL VALIDATION

Empirical validation is a vital phase of proposed research. Empirical validation is the standard approach to justify the model approval.

Speraman's Coefficient of Correlation r_s was used to check the significance of correlation among calculated values of effectiveness using model and its 'Known Values'. The ' r_s ' was estimated using the method given as under: Speraman's Coefficient of Correlation is as:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)} \quad -1.0 \leq r_s \leq +1.0$$

Where,

'd' = difference between 'Calculated ranking' and 'Known ranking' of effectiveness ,

'n' = number of projects used in the experiment.

IV. CONCLUSION

This Research paper has developed model to compute effectiveness of the class diagrams. In this paper proposed model measures the effectiveness of design properties which were used in class diagrams designing. This paper also developed Effective Implication framework and multivariate linear Effectiveness Implication Model for Object-Oriented Design. This model have been developed using the method of multiple linear regressions. The study moreover validates the quantifying ability of effectiveness model. The applied validation on the effectiveness model concludes that proposed model is highly consistent, acceptable and considerable. The values of effectiveness are of instant use in the software development process. These values help software developers to review the design and take proper corrective measures, early in the development cycle, in order to control or at least reduce future maintenance/testing cost.

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