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A Survey on Evaluating Usability of Visual Studio

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Abstract- **Programming plays an important role for Computer Science (CS) students during their degree studies. The study was conducted to evaluate the Microsoft Visual Studio programming tool to find out usability issues and recommendations were provided by experts by the help of heuristic evaluation. The main goal of this research is to initiate dialog in CS community to address the usability issues that provide a better interface to improve the usability of such kind of programming framework. It has been examined by the help of qualitative and quantitative evaluation of the user interface with novice and expert users. This Quantitative assessment is done in Bahria University Lahore Campus with the help of usability testing that helps to explore the usability problems of Visual Studio. System Usability Scale (SUS) questionnaire and After Scenario Questionnaire (ASQ) is used for taking opinions from the participants after usability testing that helps to improve the interface of the programming tool and identify the metric satisfaction. Qualitative evaluation usability inspection technique that is termed as heuristic evaluation is used by Nielson heuristics to improve the usability of the interface. The experiment was conducted in Bahria University Lahore campus in a programming course lab under a controlled environment. Population size was about thirteen; first semester students and twenty four students of third and fourth semester related to Bachelor of Information Technology (BSIT) . The result shows that the overall SUS score was around 48% of first-semester students of BSIT which is below the threshold satisfaction value. The low SUS value recommends that usability issues should be improved. On the other hand, third and fourth-semester students' satisfaction rate was above 68% that gives satisfactory results. Experts evaluated the interface by 10 Nielson heuristics and highlighted minor, cosmetic and major issues. A proper interface was suggested by the experts to produce better results.**

Index Terms-- Satisfaction, Usability, System usability scale, Heuristic Evaluation, Visual Studio

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I. INTRODUCTION

With the advancement of Information and technology, the interaction between user and technological devices are increasing day by day. Most of the users are reluctant to operate computer-operated devices because of complex or poor interfaces related to usability. Usability is a quality attribute that measures how easy user interfaces are to use. Different usability attributes should be considered to measure the interface of any product. It was recommended by Shackel [1] that four attributes are much important to accept its usability which are attitude, the effectiveness of the product, how easily the product can be learned, and how flexible is the system has an internal locus of control for users. For the acceptance of a product, we have to define four-dimensional attributes: which are effectiveness of the product, how easily the product can be learned and how flexible is the system has an internal locus of control for users [2]. Nielsen highlighted five major attributes related to usability that are:

1. Easy to learn (learnability): System should take less time to learn for the first time.
2. Efficient to use (efficiency): How efficiently and frequently a task is performed with accuracy.
3. Easy to remember (memorability): after learning the system how much time a user takes time to memorize it after time.
4. Preventing errors: the system should be less error-prone and aware of users so the user can make fewer mistakes.
5. Subjectively/Aesthetically pleasing: it shows how the user feels about the system [3].

On the other hand, Microsoft visual studio is a famous tool used by the University for teaching computer programming. Except for the theoretical study of computer science subjects, programming helps to learn practically with the help of code [4]. First-year students are given the learning environment with the help of the lab arranged for the CS courses that help the students to build, design, and develop applications easily and help in their future [5]. It has the same interface for all users of all levels. Many students of first years face usability issues and cannot perform well because of its complex interface. There is a need to examine its interface. The study is conducted to evaluate the

Microsoft Visual Studio programming tool to find out usability issues and their recommendations by experts.
In the remaining part of the paper, a detailed methodology will be discussed. Later results will be highlighted with recommendations and a conclusion.

II. USABILITY EVALUATION

Usability evaluation is the main purpose of the study where a survey with an experiment was conducted at Bahria University Lahore campus in the programming lab. Participants of this research are university students and lecturers that can be further categorized as Novice, intermediate and expert [6].
This study uses two types of satisfaction questionnaire: system-level questionnaire and test level questionnaire that assists with being familiar with the in general tool(Visual Studio) and also task-level satisfaction questionnaire that assists with knowing the ease of use of each undertaking and module that it is organized or not. SUS questionnaire is used for test level satisfaction that is open source and it helps to identify the satisfaction rate and experience of students using Visual Studio tool. After Scenario Questionnaire (ASQ) is also used in this survey defined as task level satisfaction questionnaire. ASQ helps to gather the user satisfaction for each individual task with the help of asking three questions. By the help of identifying usability metric satisfaction, usability issues of Visual Studio tool are identified that are termed according to the severity level (minor, cosmetic, major). Usability issues helps to redesign the interface in better manner by the help of given recommendations [7].

In this research, user testing is being performed in which demographic data is taken by the help of user personas. Users are university students that are observed face to face and their timing of performing the tasks is being noted with the help of Usability testing [8]. Population size was about thirteen; first semester students and twenty four students of third and fourth semester related to Bachelor of Information Technology (BSIT). Students are given the same high speed of Internet bandwidth, the same model of PCs and the same natural environment setting is defined. Tasks are being performed by the users and time is calculated by the help of stopwatch in seconds. Satisfaction rate is being identified by test level and task level analysis.

A. QUANTITATIVE EVALUATION RESULTS.

Different methodologies are used to gather the requirements and opinions from the user. To enhance the usability some approaches are used like five-star approach and binary rating approach in which the ratings are defined in the form of -1,0,1. In this survey, for collecting the opinions from the user task and test level satisfaction questionnaires are being used.

After Scenario Questionnaire (ASQ) is used for task level satisfaction that helps the user to determine the user satisfaction regarding each rating of task ranges from 1-7, where 1 shows strongly agrees value and 7 defines the value of strongly disagree. There are three questions that are being asked from the users after each scenario [9].

ASQ RESULTS
Task level satisfaction is calculated with the help of ASQ. It is defined as ASQ score of first semester students is 3.07 that is neutral score as per the individual task and the average of first semester students of IT[10]. ASQ score of third and fourth-semester students is 1.8 that is near to strongly agree score as per the individual task and the average of third and fourth-semester students of IT.
System usability scale (SUS) was used to calculate user's response by the Quick and Dirty approach as per the Brooke [4]. SUS questionnaire was distributed to the participants after the performance of the tasks (usability testing) to evaluate the performance of BSIT-1, 3 and 4 semester students of Bahria University Lahore. This SUS questionnaire helps to know the overall system-level satisfaction rate of the programming tool. Rank is assigned from 1 to 5 value, where 1 is declared as strongly disagree and 5 value is declared as strongly agree.

SUS Score	Grade	Adjective Rating
> 80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51 – 68	D	Poor
< 51	F	Awful

FIGURE 1: SUS score level.

SUS RESULTS
As defined in Fig. 1 below than 68% in the SUS scale is considered not satisfactory and above than 68% is considered a good level. Third and fourth-semester student satisfaction according to Visual Studio tasks is satisfactory. SUS final score calculated of Third and fourth-semester BSIT students is about 78% that is defined above threshold of 68% [3] and is considered satisfactory. UX is good of Visual Studio and finds the interface aesthetic pleasing, satisfactory, and ease to use the tool is as desired.
SUS final score identified for first semester is about 48% that is below the 68% threshold value as defined in Figure 1 and is not

considered satisfactory. First-year student's satisfaction rate according to Visual Studio tasks is low. First-semester students find it difficult to program as they are not intermediate and expert users and not satisfied at all according to UX/UI of Visual Studio.

III. HEURISTIC EVALUATION

The heuristic evaluation is one of the widely used evaluation methods in order to identify the usability issues of any software application. Heuristic evaluation is a technique that is the accurate technique that eventually saves travel and installation costs [11]. In this testing technique, expert's presence is necessary Expert of Visual Studio are basically Teachers of Bahria University Lahore that teaches the programming subject to BSIT students and have a great grip in using Visual Studio tool. Experts are asked for which problems they face while using this tool and give their opinions about how to improve interface usability according to their experiences [6].

A. QUALITATIVE EVALUATION RESULTS

Evaluation is done by the experts and errors are found as minor, cosmetic, and major errors. Further evaluation notes and suggestions are given by the experts to improve the interface. Nielsen's heuristics and results are discussed below:

a) VISIBILITY (HOW MUCH SYSTEM STATUS IS CLEAR)

There were 2 minor issues, 0 cosmetic, and 0 major problems that show total visible errors are 2%. Visibility issues are Visual Studio icons like comment icons for commenting on the program.

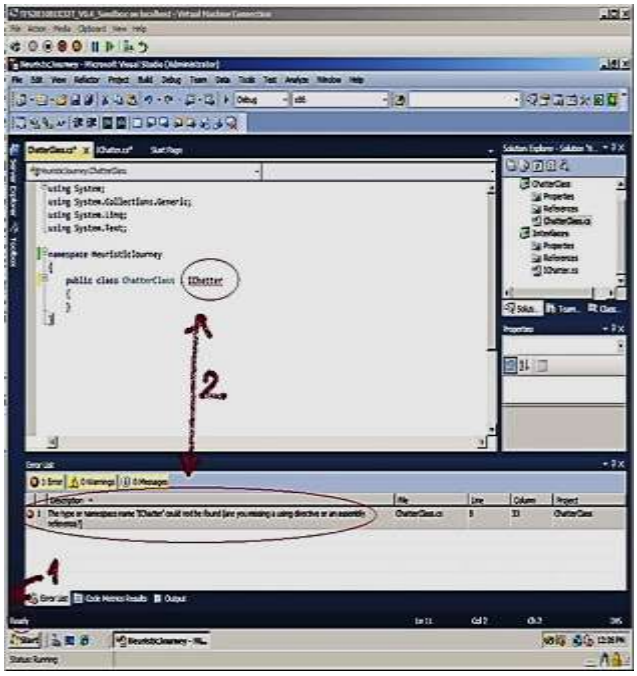

FIGURE 2: Proper visibility status

Figure 2 defines the proper visibility status in Visual Studio. With the help of feedback provided by the status bar (1) Visual Studio helps the user updated, the need of use regarding to specialized windows, like the Error List (2) and code highlighted, such as to prominent the error in the code wavy underline is used. That shows proper visibility.

b) MATCH THE INTERFACE BETWEEN SYSTEM AND REAL LIFE

Usability issues found: 0 minor issues, 8 cosmetic and 0 major problems that show total errors are 8% that can be improved with time and by adding metaphors and analogies to merge interface with real world.

Visual studio uses words, phrases, concepts and descriptions

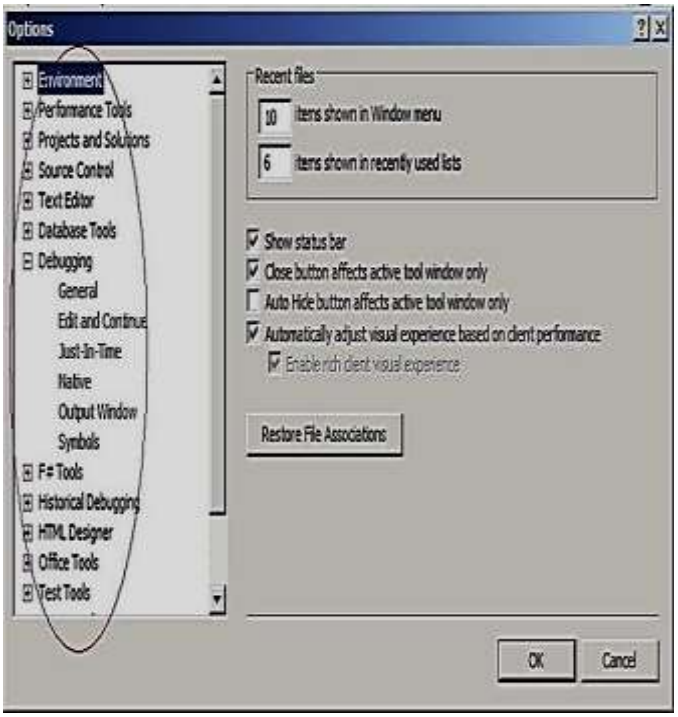

FIGURE 3: Options in Visual studio

Figure 3 defines that at first glance options provided appear confusing to the user, but the ordering is done logically of the options and further sub-options help the user to rapidly adapt and understand.

c) USER INTERNAL LOCUS OF CONTROL AND FREEDOM TO NAVIGATE.

There were 1 minor issue, 3 cosmetic, and 0 major problems that show total visible errors are 4%. Visual Studio allows users to navigate easily and switch between labels besides small changes that can be also ignored.

Users can easily do undo and redo, which also includes global impact changes, for example, code refactoring.

If accidentally Visual Basic program is created as the project creation and is set to VB by default, instead of C#. To undo this option includes un-doing manually and deletion of files, which seems to be time-consuming and unclear to novice users [4].

d) CONSISTENCY AND STANDARDS

There were 3 minor issues, 2 cosmetic, and 0 major problems that show total consistency errors are 5% that shows flow is proper of Visual Studio little standards are being to be followed.

The user interface look, feel, and feature set are consistent with the older versions of the Visual Studio. The additional features that are blended into the Visual Studio environment can be identified by the user by exploration.

In other words, if you are familiar with the environment of 2008 you will be good to go with 2010, as the interface is consistent and as the use of terminology, wizards, menu and actions is the same consistent with previous versions and are platform compatible.

Some settings of the project (2008 defaulted to AnyCPU, 2010 defaults to X86) have been amended that may cause problems to users.

e) RECOGNITION/VISUALIZATION RATHER THAN THE RECALL

There were 3 minor issues, 0 cosmetic and 0 major problems that show total visual errors are 3% that gives us the concept that Visual Studio uses more visualization rather than text so the user can easily understand.

The tool promotes the concept of information recognizing and remembering by less burden to mind by the number of ways, such as simple and properly labeled dialogs, feature to step back/forward easily in wizards, and help is provided that is context-sensitive. The new float features, also dock navigation feature, make windows undocking and docking a breeze.

f) FLEXIBILITY OF USING THE SYSTEM AND EFFICIENCY

There were 1 minor issue, 1 cosmetic and 0 major problem that shows total efficiency errors are 2% that gives us the concept that Visual Studio is efficient and fast to use.

The solution provides for the new, powerful, mouse-biased and keyboard-shortcut user, with the use of other productivity features.

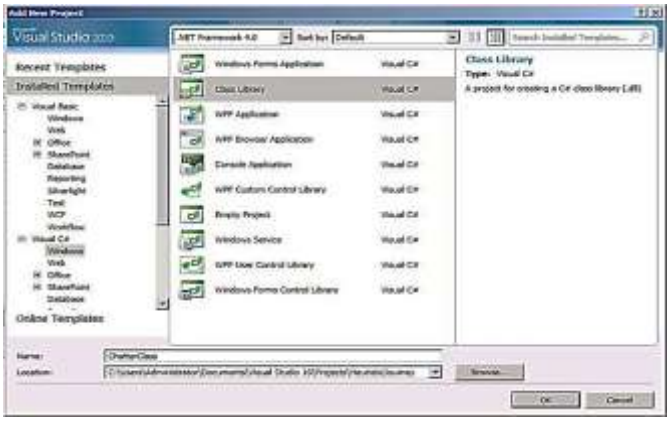

FIGURE 4: Productivity features in Visual Studio

Figure 4 defines that both novice and expert users can therefore cater their integrated development environment to uniform their styles and to tailor rapid-actions.

The toolbar is clear and consistent as regards to other releases of Visual Studio. The question that needs to keep in mind is whether the "Ribbon" concept is adopted in many of the most familiar Windows applications, such as Office [12].

g) MINIMAL AND ATTRACTIVE DESIGN

There were 2 minor issues, 1 cosmetic and 0 major problem that shows total attraction design errors are 3% that gives us the concept that Visual Studio design is attractive, simple and professional.

Home page is a new start-up page that is aesthetically pleasing. No irrelevant information is provided; information is not cluttered as its predecessors and has spontaneous images and labels for activities, such as feedback, etc.

FIGURE 5: Homepage of Visual Studio

Figure 5 defines the homepage of Visual Studio. The rest of the tool was consistent in terms of showing only the relevant information by hiding the advanced information but access is provided to "Advanced" links [13].

h) HELP USERS TO EASILY IDENTIFY, DIAGNOSE ERRORS AND RECOVER FROM ERRORS

There were 2 minor issues, 0 cosmetic and 0 major problem that shows total errors are 2% that gives us the concept that Visual Studio can easily recover from errors.

Error messages are defined both in the form of plain message and in the form of Windows-specific code, as well as giving reference to where in the program code the error was identified and debugged. The precise indication denoting the errors, as well as constructive suggestions provided are huge productivity features.

i) PROPER HELP AND DOCUMENTATION (GUIDELINES) PROVIDED.

There were 4 minor issues, 4 cosmetic and 0 major problem that shows total errors are 8% that gives us a concept that Visual Studio provided guidelines and online assistance but little difficult for new users to find help and documentation.

The context-sensitive help, offline and online help with Visual Studio is one of the best features that offer easy indexing, searching, additional samples and videos.

Some of the versions only provide online help like BETA-1, offline help will be reintroduced in the next release of BETA.

j) PREVENTING USERS TO MAKE FEWER ERRORS

There were 7 minor issues, 2 cosmetic and 0 major problems that show total errors are 9% that gives us the concept that Visual Studio provided easy reversal of action when a user mistakenly performs any action.

Visual Studio has a feature that performs validity checking while the user edits code. For example, when a user purposefully from the interface declaration deleted the public access modifier keyword, the system shows a warning that performing this action would make the interface in-accessible. This avoids error-prone actions [14]. Before deleting action is committed Visual Studio pop up the confirmation message.

TABLE I: Suggestions needed for improvement

Heuristics	Suggestions
H2	*By keeping the previously searched history and changes performed helps the user to recognize easily rather than recall.*
H3	*It should also support the undoing of the creation of program activities, including deleting all the created artifacts.*
H4	*Do not enforce users to define the project start-up defaults just allow them.*
H6	*Give user choice, as ribbons clutter down the working area of the Visual Studio intended users, consistency would be introduced for the users that are working Visual Studio and Office.*
H7	*Allow the user to effortlessly customize the start-home page.*
H10	*The tool does not warn the user when defining a private interface until it is referenced in the program somewhere.*

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IV. RECOMMENDATIONS

Usability testing was held in Bahria University Lahore campus where Bachelor of Information Technology-BSIT students were observed while performing their tasks and time in seconds was noted to perform the task. There is a comparison being made between the students of the first semester and third/fourth-semester students of BSIT. As shown satisfaction (usability metric) is considered good of BSIT 3, 4 semester students as it is above 70% and BSIT-1 students have below the satisfaction threshold value that needs to be improved. As BSIT-1 students are novice and intermediate users of Visual Studio and are learning to do programming as their starting point, most of them are from different fields that they are not experts in [13]. So the interface learning is a bit difficult for them. Major time is taken to complete the task is while commenting, as many students don't know that commenting of the program can also be done by the comment button, students do line by line commenting so they face frustration [15]. Its interface needs to be improved according to the usability issues being catered by the interface minor, intermediate or major. Major problems should be tackled immediately [16]. Table-I defines the improved suggestions given according to the error identified by the experts to enhance the interface of Visual Studio.

V. CONCLUSION

To find out the Usability of the Visual Studio task Satisfaction is checked. The target audience is the Bachelors of Information Technology students of first, third and fourth semester. Usability testing is conducted in computer programming lab of Bahria University Lahore and satisfaction rate of users were calculated by the help of SUS and ASQ satisfaction questionnaire. The results shows that first-year students don't have programming knowledge or are not experts in it so they face difficulty in performing the task most of the students face difficulty in commenting on the program and saving the program. Due to the little bit tricky outlook of the interface comment button, the run button is located on the top of the tool but they are so small that it needs to be improved by proper labeling. Third and fourth-semester students have the know-how of the programming knowledge and they are experts in it due to attention provided to the memory for working with this tool, they are frequent users and their satisfaction level is above the threshold (satisfactory level). Qualitative evaluation termed as heuristic evaluation is performed in this research where experts evaluate the Visual studio tool and define the usability interface improvements [17]. This research provides a way how to assess the tool as programming skill is the basic knowledge of the CS student and further usability of IDE Visual Studio is evaluated that needs to be further improved for novice as they take much time and interface is bit tricky for them.

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