

# Evaluation of AlgoWBIs: Experts' View

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## ABSTRACT

Along with the progress of information and communication technologies (ICT) the use of web-based instruction (WBI) is also becoming popular tool as an education resources by the. Instructors are using WBIs as a tool for delivering and distributing the learning content. In support of web based learning, a tool AlgoWBIs is developed for algorithm learning and evaluated by the various experts.

Experts' views has been taken and evaluated for the tool AlgoWBIs to know how it will be supportive for effective learning of algorithm and how it could be improved is required? Various factors have been evaluated which may influence the tool's functionality and its impact on learning.

Experts have shown positive intentions towards the tool for the effectiveness, usefulness, adequacy and quality of content. They also showed the positive view about the navigation through out the study material, self assessment of learners and various other parameters. The empirical evaluation result indicates that the tool is supportive in algorithm learning with and without face-to-face interaction among the learner and instructor.

## Keywords

Algorithm, Instructional design, Web-Based Instruction system (WBIs), Self-paced learning, Web-Based learning, Interactive learning, computer based learning, personalized learning ,Self Assessment, AlgoWBIs

## 1. INTRODUCTION

The augmented availability and use of Internet in education, increased learning and teaching through the web-based applications. It is now a popular method education [5]. Now WBIs is an alternative form of providing education. This alternative method is helpful in involvement of learner during learning and also creates an innovative learning environment [23].

Literature supports that there are numerous features of interactive learning which .

Keeping the benefits of Web-Based Interactive learning in mind a tool AlgoWBIs is developed. AlgoWBIs supports numerous features of interactive learning and supports the instructors and the learners of the information technology and computer science graduate and undergraduate courses.

AlgoWBIs not just support learning rather presents simulation, and self assessment approach to test knowledge level [3] for the various sorting techniques.

The paper starts with the literature review which discusses about the research done this area and summarize with various interactive tools. Then after paper describes about the inspiration behind the development of algorithm learning tool named AlgoWBIs. The development model used to develop AlgoWBIs is discussed further. After model used to develop

the tool description of various builds is given. Then the most important experts' review is explained. Limitations and future work is also explained at the end of paper.

## 2. LITERATURE REVIEW

Zhihai ,L., Zeng, Q., Gao, L., & Wang, C. (2011) have analyzed and designed one system according to the developing theory of software engineering, and built a functional module. The module is established and implemented for C programming course as an example of online learning system. The module is implemented by using MySQL and Dreamweaver software. Takano, K., Li, KF., & Johnson, MG. (2011) have introduced a prototype system for learning tennis. Researchers have designed a Web-Based Multimedia Sport Instructional System to give training of tennis with the objective to save time, space, and cost of training as compared to the traditional human coaching approach.

Lee, YC. & Terashima, N. (2012) has constructed A Distance Instructional System Moodle-Based Educational System which provides friendly interface to fit most students in e-learning. Where Moodle is the Modular Object Oriented Developmental Learning Environment. The modified Moodle-based educational system allows help in obtaining the browsing time of each web page for students. Further by analyzing the recorded information, instructors can find out factors which will affect students' learning performance, so as to apply the proposed learning performance evaluation mechanism to evaluate students' learning performance for providing adequate auxiliary learning materials to individual students.

Hsu, CM. (2012) studied and summarized the web-based learning platform of Computer Support for Collaborative Design (CSCD). The platform is based on theories related to a constructive learning environment model, computer-supported collaborative learning and mind mapping. The platform provides effective tools for interaction and collaborative learning by integrating the tools of mind mapping into a learning environment that utilizes CSCD and conforms to the needs of design students.

Their research includes the design and set up of a teaching website with the constructivist learning environment model, computer-supported collaborative learning theory, and mind mapping-related theories that serve as the basis, to design and set up a teaching website that aids in understanding the influence of the CSCD and collaborative mind mapping on design department students' learning attitudes, learning effectiveness, and creativity.

Kim, D.G, Lee, J. (2013) proposed the development of a web-based, intelligent instruction system to help elementary school students for mathematical computation after reviewing various researches in the same area. Researchers concentrated on the intelligence facilities which support diagnosis and

advice. According to the researchers existing web-based instruction systems merely give information on whether the learners' answers are 'correct' or 'incorrect', and only offer evaluation of the learners' results in terms of points. Researchers proposed a system which diagnoses the learner's comprehension status, and provides explanations: why did the learner make the error? The proposed system has a facility that analyses the learner's weak points and has the ability to diagnose the cause of the error, giving advice to the learners and more detailed error information than extant systems.

### **3. INSPIRATION FOR THE ALGOWBIS DEVELOPMENT**

The traditional teaching lacks in covering all possibilities of complete and disciplined learning of algorithms. The major problems in traditional learning of algorithm are the geographical barriers among the learners and instructors, cultural barrier, one-to-one assistance and the time limitations for both learner and instructor.

Literature proves that there are numerous benefits of interactive learning for graduate and undergraduate computer science learners. The benefits include the encouragement and engagement of learners to think, write and to talk about the topic during learning. Interactive learning helps the learner to be more dynamic and active.

Literature also shows that various Web-Based Instructional systems are available. These tools supports learning of computer programming, operating system, multimedia and many more. But there is not a satisfactory interactive tool for algorithm learning, so there is a need to develop a framework for teaching algorithm using WBIs.

The tool is intended to be developed in a manner to remove all those deficiencies of traditional learning. The tool is developed to overcome the constraints imposed upon traditional teaching of algorithms for professional studies. The constraint that is identified in traditional learning is the lack of ability to practice in-depth step. The lack interactivity and timely feedback from the learners is also a barrier in traditional learning that is being removed with the presented tool. One of the major constraints with traditional learning is that the instructors could not provide assistance to the individual learners while implementing algorithm, while AlgoWBIs would provide assistance individual learners.

AlgoWBIs tool presents algorithm learning, interactive examples and exercises. Tool also facilitates self assessment of learners. The tool presented here encourages the learners of algorithms to be more active and attentive during learning.

Other than the above mentioned options, an exit option in each topic allows learners to quit from the topic being learned. There is a menu button to allow learners to go on the main menu of the tool. Going through all above mentioned options is very simple as tool is very interactive and user friendly.

The overall functionality of tool is depicted in figure-3. Initially when learner interacts with the system will go through the login verification. After successful verification learning options will appear, which includes insertion sort, quick sort, bubble and selection sort. The figure also has a proposed algorithm to be implemented in future.

### **4. EXPERTS' REVIEW**

Experts' review played a vital role in order to improve the tool's effectiveness on learning. After development of AlgoWBIs a survey was also carried out among the experts

(N=50) to assess their attitudes and reactions to these methods. The survey was measured in a 5-point Likert scale (1= Strongly Disagree to 5= Strongly Agree). Various evaluation parameters have been covered to check the effectiveness and interactivity. Experts were provided questionnaire covering twenty two questions. The questions were covered to check whether the tool is effective in learning even without face to face interaction among the instructor and the learners or not, content provided with the tool is sufficient enough or not, explanation and organization of the content is appropriate or not.

Experts have also examined whether the AlgoWBIs tool could be used as an independent learning tool or could be used along with the traditional teaching pedagogy for the benefit of learners. The tool has been compared with the Computer Based Trainings. In particular, the experts were asked to respond to questions that included:

1. Overall functionality of tool is good.
2. The tool is easy use.
3. The tool will allow learners to learn effectively without face-to-face interaction with the instructor.
4. The Language of content is easy to understand.
5. Explanation of concepts is simple and easy to understand.
6. Content is relevant and sufficiently explained (depth of topics are enough).
7. Learning content provided with the tool is adequate and useful.
8. Information is appropriately organized throughout tool.
9. It is easy to navigate to different topics and sub-topics.
10. On-screen messages and what action should be taken provided with the system are clear.
11. Tool is interactive enough to involve user during learning.
12. Tool will help to encourage students for self-disciplined learning.
13. The contents provided here are helpful to accomplish the objectives of the tool.
14. Post session quizzes are correctly assessing learner's knowledge.
15. This tool can aid to traditional classroom Learning.
16. This tool can be used as an autonomous learning tool.
17. This tool is better than CBT (Computer Based Trainings).
18. There were no errors (System / Runtime/Logical) while using system.
19. The information is effective in helping me learn various algorithms.
20. It is easy to find the information when needed.
21. Look and feel of interface is good.
22. Web-Based Instructional (WBI) learning appeared to be an effective option for both undergraduates and for graduate students and professionals in a wide range of academic and professional studies.

Review is done by the experts, who are involved in teaching various courses including MCA, M.Tech. (Computer Science and Information Technology) and other graduate and under graduate programs of Computer Science and Information Technology. The reason for choosing these experts is that these are efficient enough to understand the usefulness and effectiveness and the short comings of AlgoWBIs tool for algorithm learning better than anybody else. They could compare the learning of the algorithm using AlgoWBIs tool with the traditional learning as well as with other learning tool available.

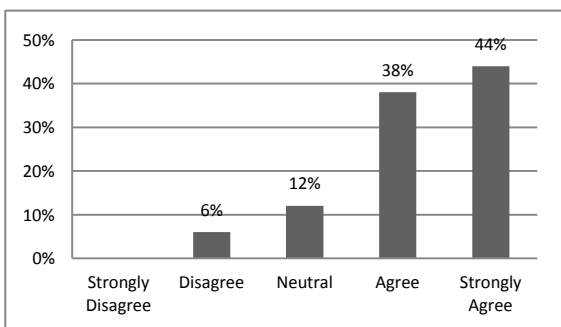
The review is done with face-to-face interaction with experts. They were requested to fill up a questionnaire, keeping the questions to check the interactivity, effectiveness, efficiency, usefulness of the tool and other related aspects. The evaluation parameters and responses in percentage are listed in the following Tables:

Experts' response shows that the tool is overall beneficial for the learners and instructors. There were, of course, also negative comments. To help improve the delivery of algorithm learning for various programs. One of the negative comment was regarding the color combinations used in the tool, while other was related to include more algorithms.

These negative comments were important in order to improve the interactivity and over all learning through the tool. These are comments are dissatisfaction of color combination used, number of algorithm covered could be more, time used during examples should be increased. Pictorial representation of the respondents as shown below.

**4.1 Table 1: Question 1**

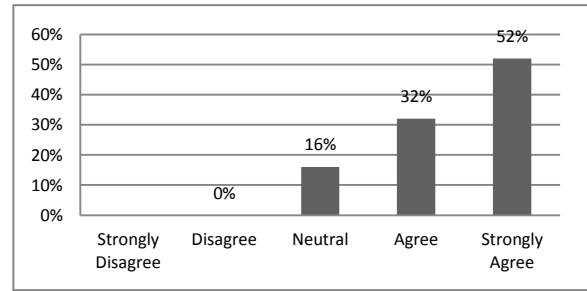
Functionality of tool	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	6%	12%	38%	44%



38% of the respondents reported that they are agree with the good functionality of the tool, where as 44% are strongly agree, 12% of the respondents are natural and 6% of respondents are not satisfied with the functionality of the AlgoWBIs.

**4.2 Table 2: Question 2**

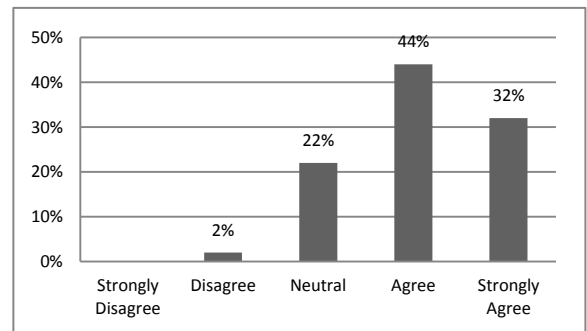
Easy to use	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	0%	16%	32%	52%



More than half of the majority (52%) are strongly agree that the tool is easy to use, while 32% are agree, 16% of the respondents are neutral.

**4.3 Table 3: Question 3**

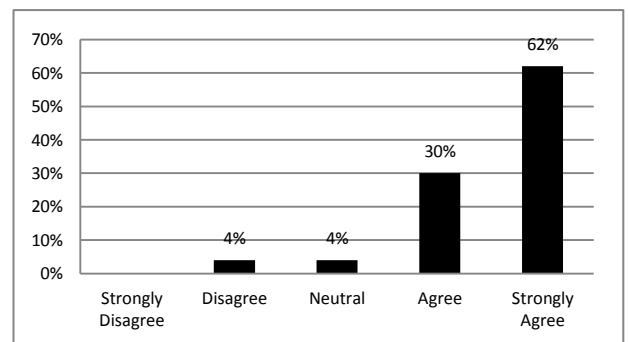
Effectiveness of learning	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	2%	22%	44%	32%



44% of the respondents reported that tool will be helpful in effective learning, 32% are strongly agree with the same. 22% of the respondents are neutral and 2% of respondents are not agree with its effectiveness.

**4.4 Table 4: Question 4**

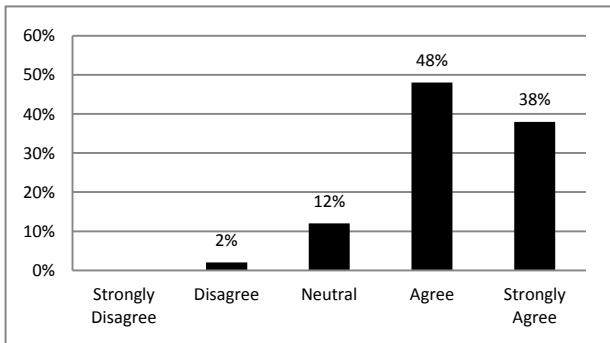
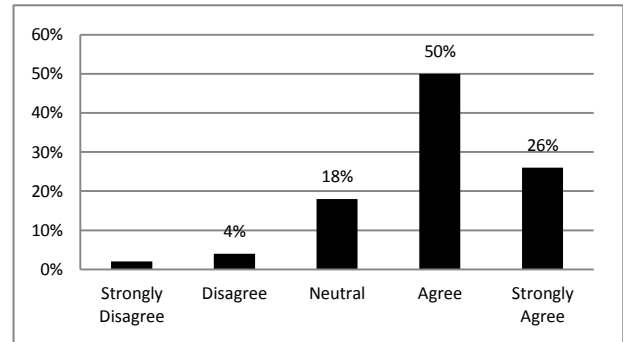
Understanding of content's Language	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	4%	4%	30%	62%



More than half of the majority (62%) are strongly agree that the content's Language is understandable, while 30% are agree, 4% of the respondents are neutral and only 4% of the respondents are not satisfied.

**4.5 Table 5: Question 5**

Concept understanding	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	2%	12%	48%	38%



38% of the respondents reported that they are strongly agree that the concept provided with tool is understandable, where as 48% are strongly agree, 12% of the respondents are neutral and only 2% of respondents are not satisfied.

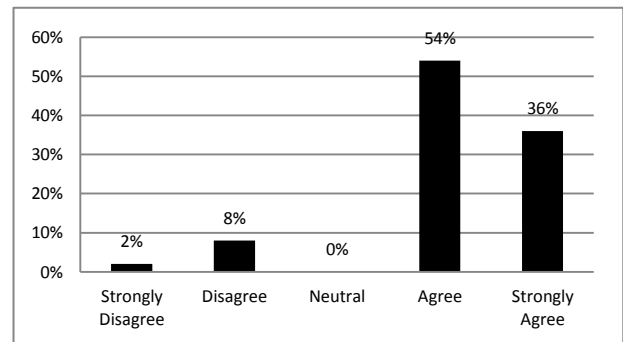
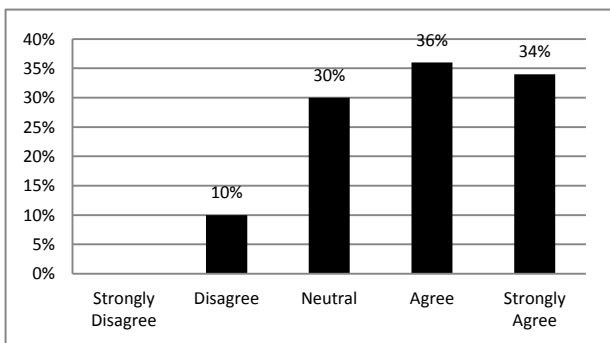
**4.6 Table 6: Question 6**

Depth and Relevance of Content	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	10%	30%	36%	34%

Half of the majority (50%) of respondents reported that they are agree that the content provided with the tool is adequate, while 26% are strongly agree, 18% are neutral and 4% are disagree and rest 2% are strongly disagree.

**4.8 Table 8: Question 8**

Organization of information	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	2%	8%	0%	54%	36%



34% respondents are strongly agree with the Depth and Relevance of Content provided, 36% respondents are agree, 30% of the respondents are neutral and 10% are not satisfied with the and Relevance of Content provided with the tool.

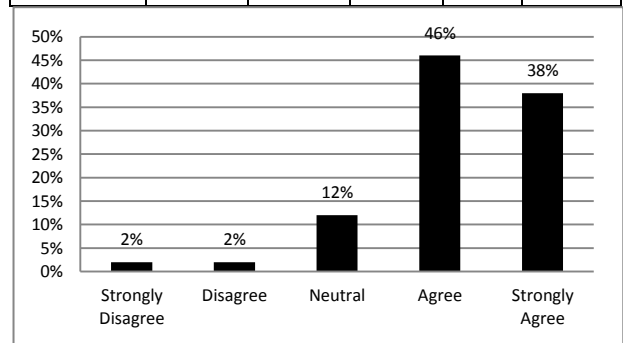
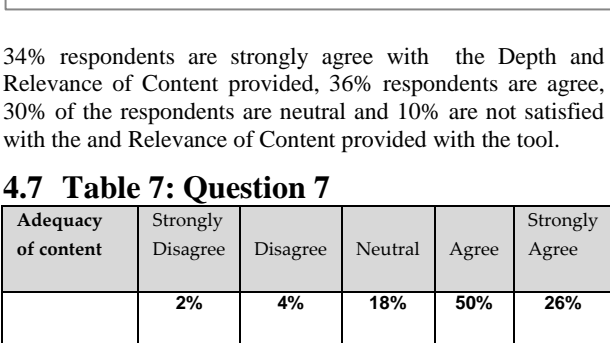
54% respondents reported that they are agree that the information provided is organized, 36% are strongly agree, 8% are disagree where as 2% of respondents are strongly disagree.

**4.7 Table 7: Question 7**

Adequacy of content	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	2%	4%	18%	50%	26%

**4.9 Table 9: Question 9**

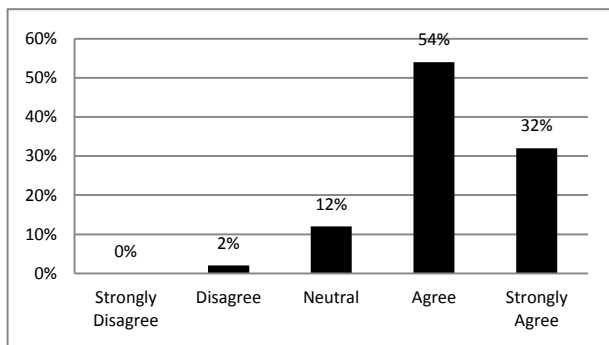
Navigation through Topics	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	2%	2%	12%	46%	38%



38% respondents are strongly agree that they can easily navigate through the topics easily wherever required, where 46% respondents are agree, 12% of the respondents are neutral and 2% are not satisfied with the navigate provided with the tool and rest 2% are strongly disagree.

**4.10 Table 10: Question 10**

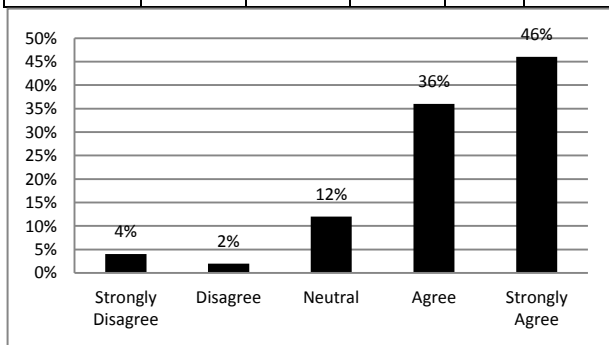
Clarity of On-Screen Messages	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	2%	12%	54%	32%



More than half of the majority (54%) are agree that there is clarity of On-Screen Messages in the tool, while 32% are strongly agree, 12% of the respondents are neutral and rest 2% are disagree.

**4.11 Table 11: Question 11**

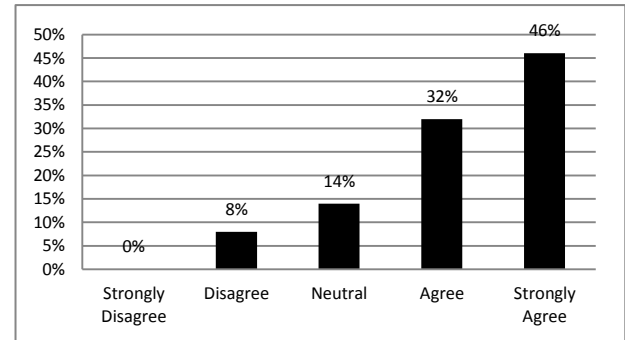
Interactivity of Tool	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	4%	2%	12%	36%	46%



46% respondents are strongly agreed that tool is interactive, where 36% respondents are agree, 12% of the respondents are neutral. 2% of the respondents are not satisfied with the interactivity provided with the tool and rest 4% are strongly disagree.

**4.12 Table 12: Question 12**

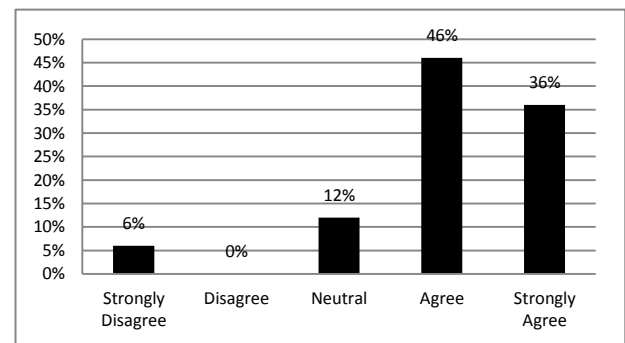
Encouragement of Self-Disciplined Learning	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	8%	14%	32%	46%



46% respondents are strongly agree that tool will be helpful in encouraging learners in self-disciplined learning, 32% respondents are agree, 14% of the respondents are neutral and rest 8% are disagree.

**4.13 Table 13: Question 13**

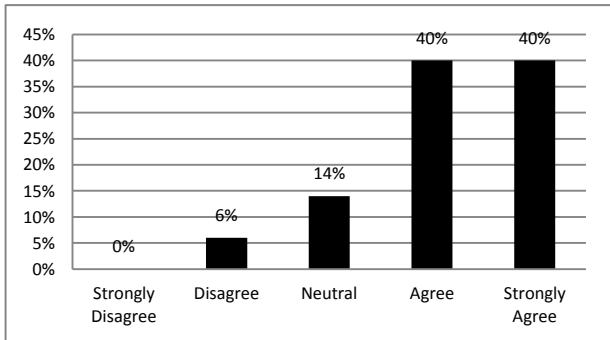
Accomplishment of Objective	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	6%	0%	12%	46%	36%



46% respondents are agreeing that tool will accomplish the objective of interactive learning, 36% respondents are strongly agreed and 12% of the respondents are neutral. No respondent is disagreeing.

**4.14 Table 14: Question 14**

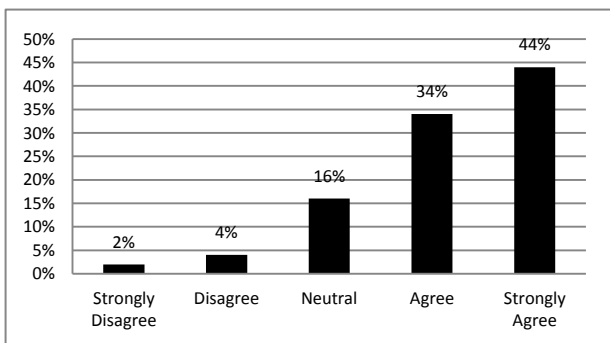
Assessment of Learner's Knowledge	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	6%	14%	40%	40%



40% respondents are strongly agree that tool is featured with learner's knowledge assessment, 40% respondents are agree, 14% of the respondents are neutral while only 6% of the respondents are not satisfied.

**4.15 Table 15: Question 15**

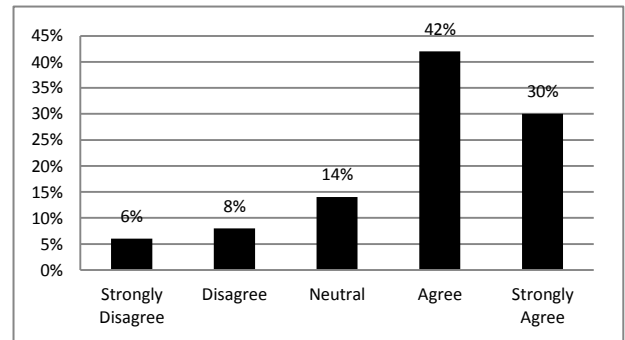
Association with Traditional Learning	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	2%	4%	16%	34%	44%



44% respondents are strongly agree that tool can be association with Traditional Learning of algorithm, where 34% respondents are agree, 16% of the respondents have not said anything in this respect. 4% of the respondents are not in favour to utilize the tool with the traditional learning, and 2% are strongly disagree with this.

**4.16 Table 16: Question 16**

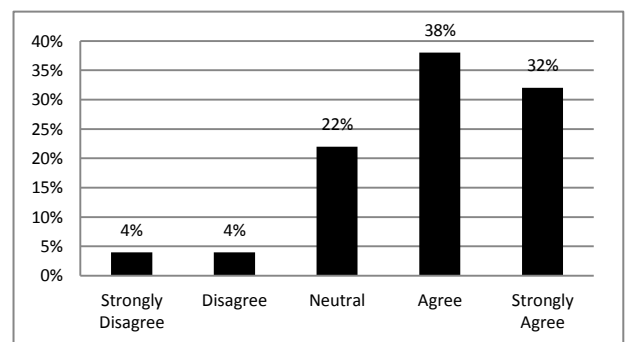
Independent from Traditional Learning	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	6%	8%	14%	42%	30%



42% respondents are agree that tool can be used independently for learning algorithm, where 30% respondents are strongly agree, 14% of the respondents have not said anything. 8% respondents are not in favour to utilize the tool as an independent learning tool while rest of 6% are strongly disagreeing.

**4.17 Table 17: Question 17**

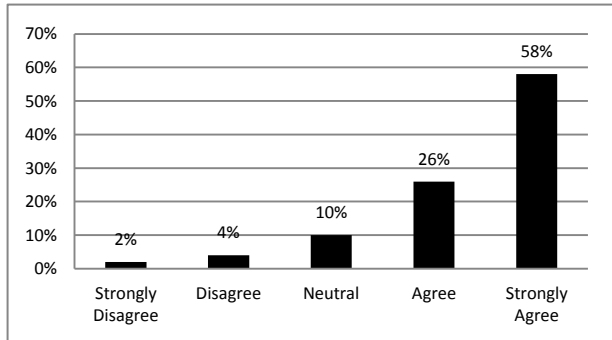
Better Than CBT	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	4%	4%	22%	38%	32%



38% respondents are agree that the tool is better than the Computer Based Training (CBT), where 32% respondents are strongly agree, 22% of the respondents are neutral. 4% respondents are disagreeing and 4% are strongly disagreeing.

**4.18 Table 18: Question 18**

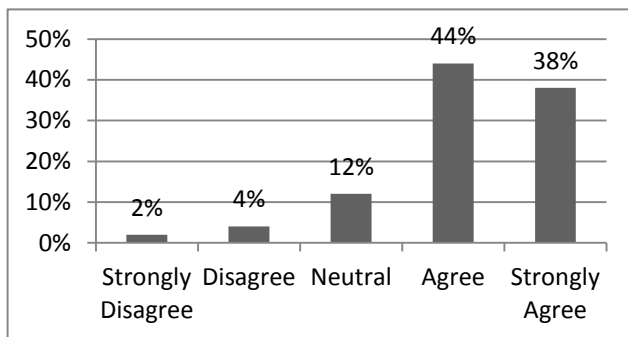
Error Free	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	2%	4%	10%	26%	58%



More than half of the majority (58%) are strongly agree that tool is error free, 26% are agree, 10% of the respondents are neutral, 4% are disagree and rest 2% are strongly disagree.

**4.19 Table 19: Question 19**

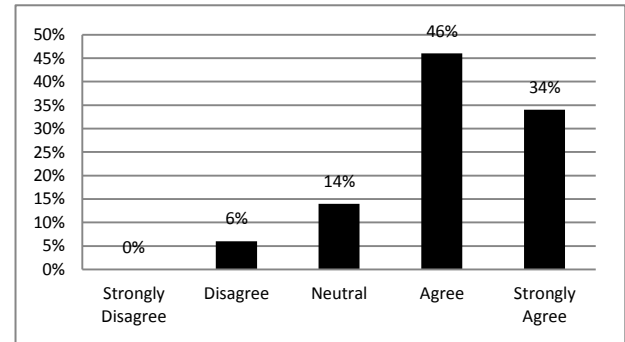
Effective for Algorithm Learning	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	2%	4%	12%	44%	38%



44% respondents are agree that tool is effective for algorithm learning, 38% respondents are strongly agree, 12% of the respondents are neutral. 4% are disagreeing with the effectiveness of the tool while rest 2% are strongly disagree.

**4.20 Table 20: Question 20**

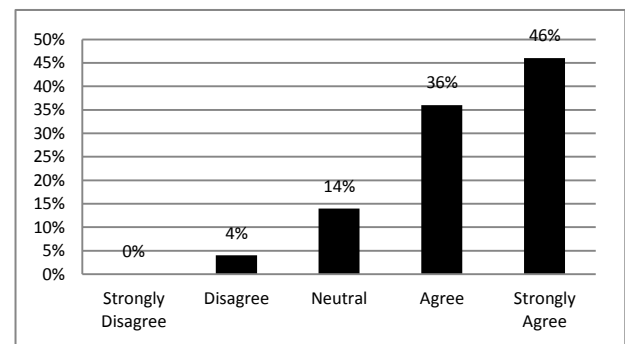
Easy to Find Information	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	6%	14%	46%	34%



46% respondents are agree that learners can easily find out the information he or she wants, 34% respondents are strongly agree, 14% respondents are neutral while rest 6% are disagree.

**4.21 Table 21: Question 21**

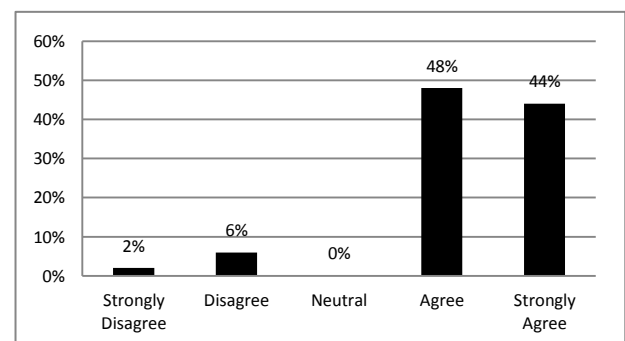
Look and Feel of Interface	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	0%	4%	14%	36%	46%



46% respondents are strongly agreed that the look and feel of interface is satisfactory, 36% respondents are agreeing, 14% of the respondents are neutral. 4% are disagreeing.

**4.22 Table 22: Question 22**

Effectiveness of WBI for learning algorithm	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	2%	6%	0%	48%	44%



44% respondents are strongly agree that the Web-Based Instructional for learning algorithm is effective, 48% respondents are agree, 6% of the respondents are disagree while rest 2% are strongly disagree.

## 5. LIMITATIONS

The evaluated tool seems to be supportive and interactive for learning. It will also improve the efficiency of the learners and instructors both.

Bearing various features does not mean that the tool is perfect and does not have any demerit. There are various limitations are also. The tool may not be fully utilized by learners and instructors without proper training, however messages are being prompted whenever required.

Another limitation of the tool is the number of algorithm implementation. Tool is facilitating the learning for sorting algorithms only.

## 6. CONCLUSION

The evaluation result summarizes that the presented tool is highly interactive and will be supportive in reducing efforts of learning. Evaluation shows that the tool is able to make the learning easy and interactive.

Data collected showed that collaborative education is accepted by a lot of students. Students finished their assignments with greater motivation. Students would like to interact with teachers and greatly welcome real world cases.

The experts' responses show that the tool is able to fulfil most of the learning requirements for sorting but there is always scope to upgrade the tool by providing new features, or by making changes in existing features. Further the tool will be evaluated by the learners.

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