Effectiveness of Spoken Tutorial Method in Software Training

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Abstract

Purpose: The objective of the research work is to find the effectiveness of the training programs conducted to enhance software competency by IIS Deemed to be University in collaboration with IIT Bombay Spoken Tutorial Project during pandemic as a part of National Series on Student Development Programme.

Design/methodology/approach: The descriptive research design was used and a survey was used to take feedback of participants and 52 participants gave feedback.

Findings: Among the 3 courses offered Python had maximum respondents followed by Latex and R Programming. Without considering completion rate all teaching components were 91% effective at 0.01 level of significance and 88% effective at 0.05 level of significance. However, on considering course completion rates the percentage effectiveness of all teaching components falls to 49 % and 48% at 0.01 and 0.05 level of significance. Based on respondent feedback it was found that the reflective level of attainment was low but spoken tutorial was an asset in the eyes of 75% of respondents.

Practical implications: Without measuring the effectiveness of any training program the Deming Cycle of Plan, Do, Check and Act is incomplete and continuous improvement is impossible without taking feedback. Hence measuring effectiveness by taking feedback of participants is essential .

Originality/value: The study is for measuring effectiveness of Spoken Tutorial Method using expectations met, learning outcomes achieved and teaching component effectiveness .63% respondents approved the idea of Health checker introduction to check the compatibility of software to be learned with the learner computer processor and operating system. The study uniquely highlights some reasons for shortfall in effectiveness of the Spoken Tutorial Method.

Keywords: Effectiveness, Plan Do Check and Act, Learning Outcomes, Teaching Component Effectiveness, Health checker

Introduction

According to (Jain, UGC Advisoryregarding COVID, 2021) Higher Education Community has to play an active role during COVID-19 crisis and has to focus on the five fold strategy of Testing, Tracing, Treatment, COVID appropriate behaviour and vaccination .The UGC is expecting the academic fraternity to spread awareness about COVID using appropriate media (Jain, Notices@UGC, 2021). Due

to above instructions by UGC people from top to bottom in any institute including Vice Chancellors, Principals, Faculties, Students and Staff are expected to spread awareness about COVID appropriate behaviour as shown in (Ministry of Health and Family Welfare, An Illustrated Guide on Covid Appropriate Behaviour)using Print/Social/Electronic media.

So, during these tough times when COVID was prevalent across the globe, IIS deemed to be University in association with IIT Bombay Spoken Tutorial Project took an initiative to organize National Series on Student Development Programme (Self-paced) from 23rd November to18th December 2020 (University, 2020).The objectives of the programme as mentioned in (University, 2020) were -1. Students learn latest technologies as per industry demand 2. To broaden career opportunities for students 3. To develop self-learning capabilities in the learners by providing them a platform for self-paced learning. There are different types of training / teaching modes through which teaching learning takes place shown in Figure 1.
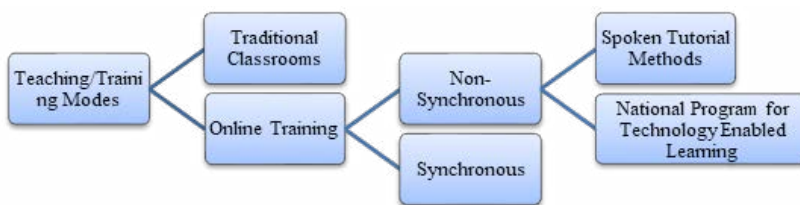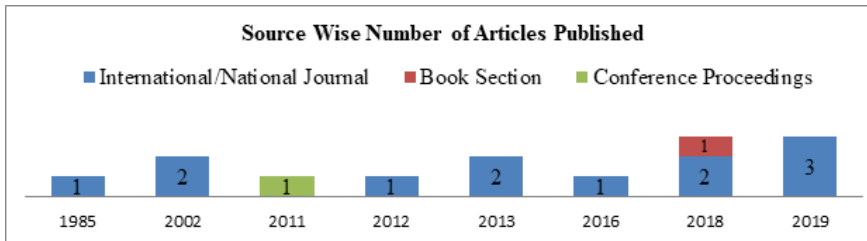

Figure 1: Different Teaching/Training Modes { (Bombay, 2020) (Team N. , 2021)}

If comparison between Spoken Tutorial Method(STM) and NPTEL Programmes is done it is evident that both are Non-Synchronous (students can learn at their own pace at their own convenience using internet by downloading content or watching online) and both have recorded lectures .STM is specifically designed for software practice and that too side by side with partitioned screen during learning and NPTEL is not specifically designed for software practice and there is no emphasis on side by side practice of softwares. In STM assignment submission is subjective type and in NPTEL assignment submission is mandatory for course completion and may be objective/subjective type.

Literature Review

14 articles related to effectiveness were reviewed in order to understand the definitions of effectiveness, the methodology for measuring effectiveness, the research instruments used, the research designs used, the data type used, the sample size and sampling type used, the program type, the learning mode used and the statistical testing methods used. Figure 2 shows source wise article distribution.

Source Wise Number of Articles Published

■ International/National Journal   ■ Book Section   ■ Conference Proceedings

| 1985 | 2002 | 2011 | 2012 | 2013 | 2016 | 2018 | 2019 |

Figure 2: Source Wise Number of Articles Published (D'Souza, October 2018) (Shree, January-June 2018) (Anand, 2019) (BYadav & S.Pingle, 2016) (Chhadva & Kacker, 2013) (Chris Watkins, 2002) (Krishnan, 2002) (Cowan, 1985) (Mangal & Mangal, 2018) (S.Poornima & T, 2013) (T, 2012) (Tahir, January 31-February 3rd 2011) (Trakru & Jha, 2019) (Worku, 2019) (D'Souza, October 2018) (Shree, January-June 2018)

On analyzing the content it was found that in 66.67% of the research papers Statistical Testing was done and 33.33% of the papers did not use any statistical testing and the one's using statistical testing used chi-square and paired sample t test 83.33% of the papers were empirical and 16.67% of the papers were conceptual or theoretical .The duration of the training program in hours was not mentioned in any of the research papers and only overall duration was mentioned . The research design used in 25% of the research papers was Exploratory , in 58.33% was Descriptive and involved primary data collection through questionnaires .Rest 16.67% of the research papers used Experimental research design .77.78% of the questionnaires used were self-constructed by the authors and 22.22 % of the questionnaires used were constructed by using other author questionnaires as mentioned in (BYadav & S.Pingle, 2016) (Chhadva & Kacker, 2013) and nothing was mentioned about the validity, reliability, standardization and objectivity of the questionnaires prepared and used .

Learning outcomes differ in different training programs ,duration of the training programs were not mentioned in all training programs and some considered on the job experience also as a part of training .The training programs for which effectiveness was measured varied from e-learning's ,ICT enabled classrooms involving usage of PowerPoint and specific programs such as Entrepreneurship development programs, Super brain yoga ,Life skills programs, Employee development programs ,Mobile learning modules for Balanced Diet and the participants for all were different .The Quasi-Experimental type of Experimental design was used in the 2 research papers which is of 2 types 1.time series and 2.multiple time series type.

The effectiveness was measured in form of variation in level of learning before and after the training in all studies except one which involved questions about inputs (resource person, duration of program, timely coverage of content and topics) and whether participants were satisfied with the development modules.

Research Methodology

Sample Size: 52 participants out of which 45 were enrolled in Python, 37 in R Programming and 40 in Latex .98% of the participants were students and 2% were pass outs .87% of the participants were from IIS Deemed to be University and remaining 12% belonged to organizations like Rajasthan University, Guru Gobind Singh Indraprastha University, SS Jain Subodh PG Mahila Mahavidhlya and AIACTR. For 2% of the participants the organization they belong to was not known. Course wise participant distribution is shown in **Figure 3** .
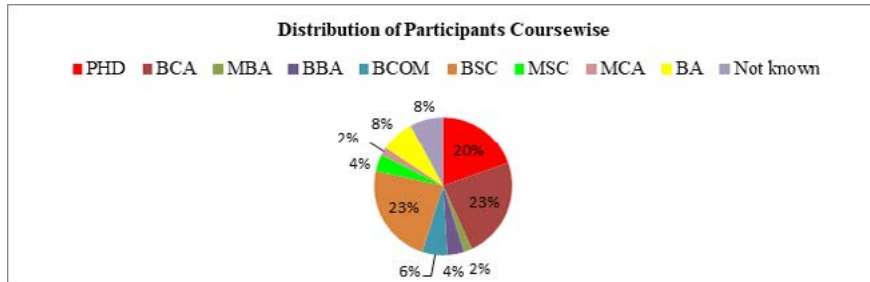
Figure 3: Course wise Participant Distribution

Source: Primary Data

Sampling Type: Participants were sent the brochure by the college and those who were interested registered for the programs on their own. The feedback form was shared in the telegram group formed by (University, 2020) and interested students filled the feedback form. The sampling was non-random Quota/Convenience type of sampling as the group of registered participants was formed.

Research Design: It is **Descriptive** type of research design using a questionnaire

Research Type: The research is classified based on objectives into different categories as shown below where research type and relevant objective to the type is mentioned.

1.Exploratory - To find out whether the Spoken Tutorial Method was effective in

a) Achieving the learning outcomes.eg: In improving software skills of the students during pandemic, has been an Asset in Enhancing Knowledge at convenience and saving Money and Time during Pandemic, is helping students to learn courses without the need to go to College Labs during pandemic, has helped in achieving memory, understanding and reflective level of teaching goals

b) Satisfying the students enrolled eg: Are Expectations met during the Training Program, are there were any Points/Opportunities for Improvement in STM

c) Achieving effective inputs as according to (Team E. , 2009) effective inputs result in effective outputs (Effectiveness of Teaching Components in the eyes of Respondents)

2. Descriptive: To find out the number of enrolments in different courses, number of students completing the course.

3. Correlational: To find out the relation between familiarity of concepts and teaching goal attainment.

4. Explanatory: To find out reasons for shortfall in effectiveness and their relative importance

Data Type – Primary data was collected.

Research Instrument Validity and Reliability – A Questionnaire was designed in the online survey software eSurveysPro and the survey link was shared .The reliability was 0.67 which was calculated using Microsoft excel after entering the responses in coded form and using Chronbach Alpha test .The validity of lies in the fact that it should serve the purpose for which it is designed .The questionnaire was designed to measure the effectiveness and 5 experts from education, training & coaching and other manufacturing/service industries were contacted and 60% of them felt that the questionnaire is valid and 40% of them felt it is partially valid .Same validity survey was used in (Chaturvedi & Rai, 2021).

Formulated Hypothesis

3 Hypotheses were formulated .H_1, H_2, H_3 are the Null Hypothesis and H_{a1}, H_{a2}, H_{a3}, H_{a4} are the Alternate Hypothesis. H_1 stated "It is believed that there was no significant impact during the training." H_2 stated "It is believed that all reasons for shortfall in effectiveness are uniformly distributed i.e. all reasons were equally chosen by participants." H_3 stated "It is believed that all teaching components are equally effective in the eyes of participants." For H_1 testing paired t test was chosen as categorical data on teaching level attainment was converted into numerical data and as sample size is greater than 30 it is assumed that the normal distribution condition is fulfilled. For H_2, H_3 Chi Square Goodness of Fit Test was applied. The data relevant to H_2 testing was collected in form of Mutually Exclusive categories with respondents stating whether a reason, to some extent a reason or not a reason and the data relevant to H_3 was collected in form of Mutually Exclusive categories with respondents stating whether teaching components were effective, partially effective or not effective. Hence the assumption of categorical data was fulfilled for Chi Square Goodness of Fit Test and the assumption of interval or ratio data was fulfilled for paired t test.

Results and Discussion

1. Python attracted maximum number of 45 enrolments followed by 40 in Latex and 37 in R programming .However the difference in enrolment rate may be due to varied interest of participants , the applicability and demand of courses in jobs or difference in motivation level as many students were not motivated enough to start the R programming /Latex program as shown in Figure 4.This may be because of technological glitches or exhaustion due to excessive screen time as these were the 2nd and 3rd courses after Python .

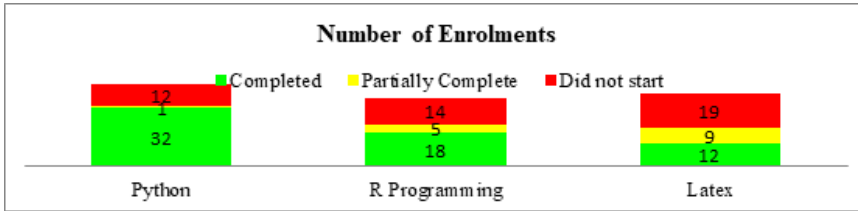**Number of Enrolments**

Completed | Partially Complete | Did not start

Python: 12, 1, 32
R Programming: 14, 5, 18
Latex: 19, 9, 12

Figure 4: Number of enrolments and course completions in different programs

Source: Primary data

2. The completion of course is an indicator of success for any program and it was 71.11 , 48.65 and 30 percent for Python, R and Latex which may be due to difference interest of student , ease of running and compatibility of different programs on the student computers having different operating system , different processors etc., time shortage(completion is specified duration was difficult) ,difficulty faced by student in coping up with online program due to health impact because of radiations emitted by devices like laptop ,mobile etc.

3. The familiarity also varied in the 3 programs with around 31, 12 and 8 percent students familiar with Python, R programming and Latex course as shown in **Figure 5** .

Percentage of Students Familiar with the Course Content

Familiar | Partially Familiar | Not Familiar

Python: 44.23, 25, 30.77
R Programming: 69.23, 19.23, 11.54
Latex: 78.85, 13.46, 7.69
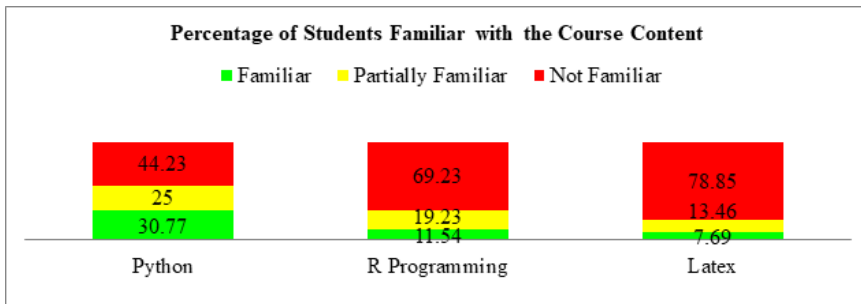
Figure 5: Percentage of respondents familiar with different courses

Source: Primary data

4. The percentage of respondents who felt that Spoken Tutorial Method is a better method for learning Python , R Programming and Latex as it allows side by side practice was 62,57 and 63 % respectively as shown in **Figure 6** .Screen size of laptop may be also a factor that impacts learning of students as in side by side practice one screen is shared by the tutorial and the software window for real practice of commands .
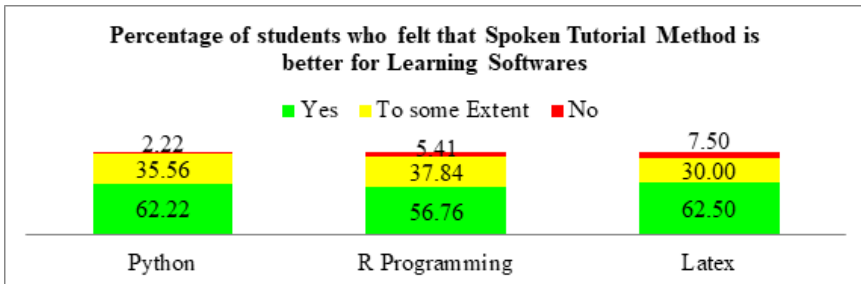
Figure 6: Percentage of respondents who felt that Spoken Tutorial is better for Learning Softwares

Source: Primary Data

5. 75% of the respondents agreed to the fact that Spoken Tutorial Method was an asset in enhancing knowledge at convenience and it saved time and money during pandemic, 4% felt otherwise and remaining 21% felt that this was true to some extent.

6. The respondent opinion varied with respect to the points/opportunities of improvement in the Spoken Tutorial Method which is clearly evident in the **Figure 7** below .Maximum 40 percent of students felt that additional readings were required to enhance clarity and minimum 18 % felt that the problem resolution pace was slower than expected which demotivated the participants .Audio and Video Quality were the 2nd most recommended point for improvement by the users .
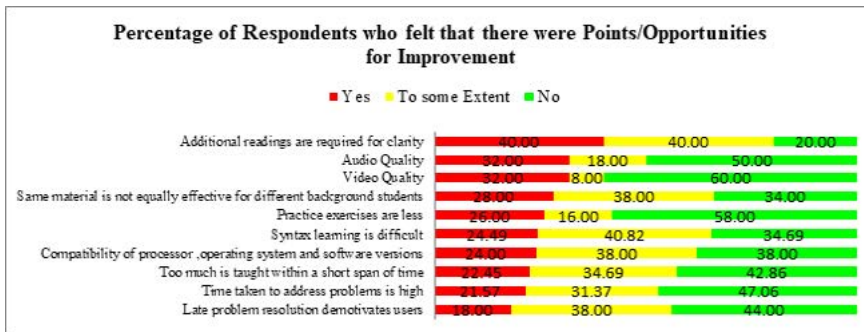
Figure 7: Percentage of Respondents who felt that Spoken Tutorial Method can be improved in mentioned areas

Source: Primary Data

7. 29% participants felt that there were no points of improvement. Around 51% participants partially felt that the Spoken Tutorial Method does not need any im-

provement and 20% were sure that the software requires improvement.

8. The level of teaching goals accomplished varied in all 3 trainings as shown in Figure 8**.** The participants were able to gain maximum awareness in Latex followed by R Programming and Python. This difference might be because of difference in initial familiarity in concepts related to above software programmes or because of interest or difficulty level.
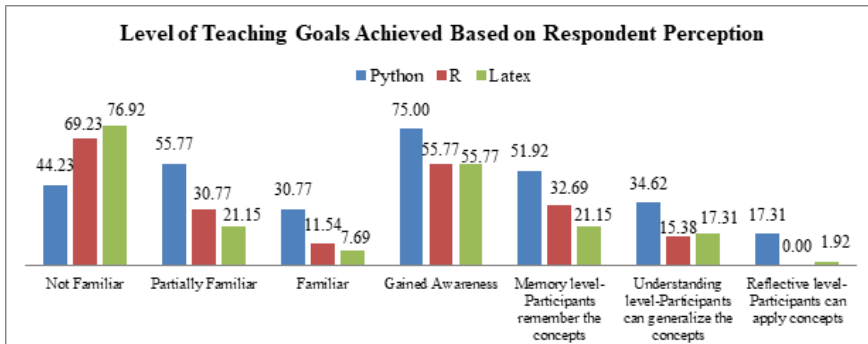

Figure 8: Level of Teaching Goals Accomplished in Training Based on Respondent Perception

Source: Primary Data

9. 63% percent of students felt that a health checker introduction to check the compatibility of software to be learned with the operating system and processor of student computer/laptop prior to training will improve the experience of students and 37% felt partially that it is a solution.

10. Teacher effectiveness was maximum in the eyes of participants followed by Instruction Material, Virtual Platform and Teaching Methodology Effectiveness as shown in **Figure 9** .
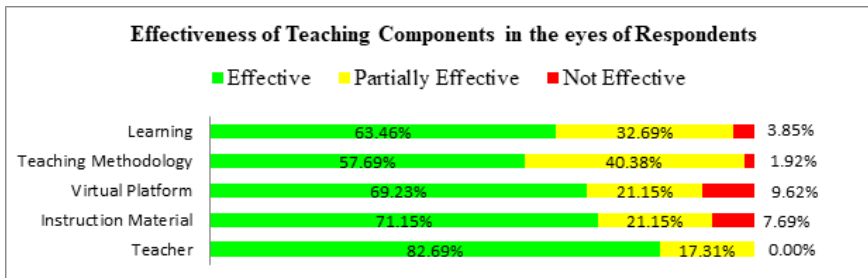

Figure 9: Effectiveness of Teaching Components in the eyes of respondents
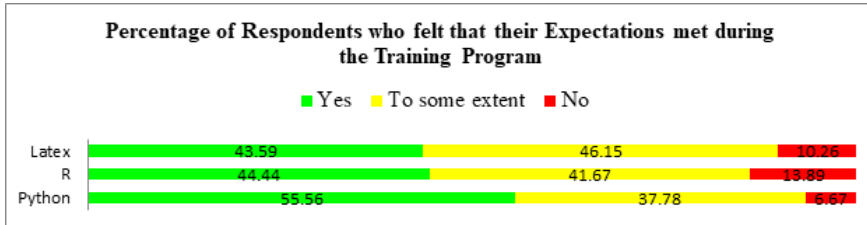
Source: Primary Data

11. 62% of respondents agreed that Spoken Tutorial helped them learn courses from home without the need to go to college laboratories and 2 % felt otherwise

and 36% felt that this had happened to some extent .

12. Not all respondents felt that their expectations were met during the training program as only 56% ,44% and 44% were satisfied with Python , R and Latex training programs and 38%,42%,46% felt that their expectations were partially met as shown in **Figure 10**.

Figure 10: Percentage of respondents who felt that their expectations met during the training program

Source: Primary Data

13. For hypothesis 1 paired t test was applied and there was a significant difference observed in the teaching goals accomplishment as t critical at 0.05 level of significance was -2.92 and -5.15 was t calculated which is less than t critical and hence we fail to accept null hypothesis and hence it is concluded that there is a significant difference after the training .

14. The Chi-Square goodness of fit test was used to find whether all reasons for shortfall in effectiveness were uniformly distributed or some reasons were stated more by participants. At 0.05 level of significance and 9 degrees of freedom the Chi Square critical value was 16.919 and observed value was 12.1869 and as observed chi square value is less so we fail to reject the null hypothesis. Hence, all reasons for shortfall in effectiveness were uniformly distributed and no reason was a preferred reason .

15. The Chi—Square goodness of fit test was used to find whether all teaching components were equally effective or not. The chi-square observed is 20.56196 when expected effectiveness percentage is 96 and 18.883 when expected effectiveness percentage is 95 %.At 0.01 level of significance chi square critical is 13.2767 at 4 degrees of freedom and as observed chi square is greater than chi square critical is is a failure to accept null hypothesis . Ultimately at 91% expected effectiveness chi square observed is 12.898 which is less than chi square critical 13.2767 and hence it is a failure to reject null hypothesis and hence the inference drawn is that all teaching components are 91% effective at 99% confidence level .Similarly at 0.05 level of significance and 4 degrees of freedom chi square critical is 9.4877 and and chi square observed is 12.898 at 91% expected effectiveness and 9.2457 at 88% expected effectiveness so it is a failure to accept null hypothesis at 91% expected effectiveness and failure to reject null hypothesis at 88% expected effectiveness .Hence inference drawn is all teaching components are 88% effective at 95% confidence level .

Above results are without considering the completion percentage .If completion percentages will be considered then taking the average completion rate of 3 courses the effectiveness will be low .The average completion rate of the 3 courses is 49.92% .Using the hit and trial method Chi Square observed was 107.177 at 80% expected effectiveness ,38.729 at 60 % ,16.001 at 51% ,13.971 at 50% ,12.061 at 49% ,10.281 at 48% and 8.638 at 47% .The chi square critical was 13.2767 at 99% confidence level and 4 degrees of freedom and 9.4877 at 95% confidence level and 4 degrees of freedom. Hence it was a failure to accept null hypothesis till 50% and above expected effectiveness .It was a failure to reject null hypothesis at 49% expected effectiveness and 48% expected effectiveness at 99 and 95% confidence level .So all teaching components were 49% effective and 48% effective considering completion rates at 99% and 95% confidence level .

Conclusions

1. Python was the most preferred choice for learning by respondents with 86.54% enrollments followed by Latex with 71.15% and then 76.92% enrolled in R Programming .

2. In paired t-test as described in point 13 of results and discussions section a significant difference was observed in the learning of the participants as a result of the training.

3. The Figure 11 shows the learning outcome achievement percentage .There are 3 colour zones ,the green zone is for 76 to 100% accomplishment , the yellow zone is for 51-75% accomplishment and the red zone is for below 50% accomplishment .The decision matrix design is inspired by ((DS/QMM4), 2009) and is shown in Figure 12 is used to find out the final accomplishment in the 7 learning outcomes shown in Figure 11.
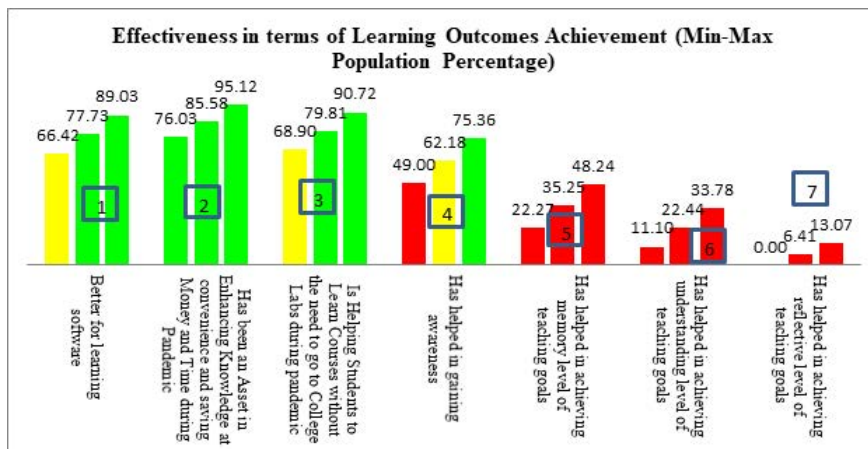
**Figure 11: Learning outcomes achievement percentage**

Source: Primary Data

Decision Matrix				
Minimum Population Proportion	Sample Proportion	Maximum Population Proportion	Result	Result Description
76-100	76-100	76-100	76-100	Good accomplishment
51-75	76-100	76-100	76-100	Good accomplishment
51-75	51-75	76-100	51-75	Fair accomplishment
0-50	51-75	76-100	51-75	Fair accomplishment
0-50	0-50	76-100	0-50	Poor accomplishment
51-75	51-75	51-75	51-75	Fair accomplishment
0-50	51-75	51-75	51-75	Fair accomplishment
0-50	0-50	51-75	0-50	Poor accomplishment
0-50	0-50	0-50	0-50	Poor accomplishment

Figure 12: Decision Matrix (Inspired from Quality Assurance Matrix given in ((DS/QMM4), 2009)

In learning outcome 1,2,3 there is a good accomplishment, in 4 it is a fair accomplishment and in 5,6,7 there is a poor accomplishment based on the perception of the participants. Overall the accomplishment levels can be termed as fair and hence the Spoken Tutorial Programs are partially effective .

2. Effectiveness based on Customer Satisfaction which is the first principle of Quality Management is shown in Figure 13.Using the decision matrix shown in Figure 12 it is evident that in 1,2,3,4 criteria shown below there is a fair accomplishment.
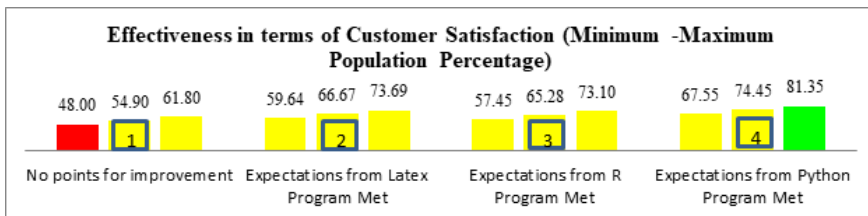
Figure 13: Effectiveness from Quality Management Perspective

Source: Primary Data

3. Effectiveness of all teaching components is 91% and 88 % and 49% and 48% at 99 and 95 % confidence level which means that it is a good accomplishment without considering completion rates and it is a poor accomplishment if completion rates are considered .

4. It is believed that in between 75.9 percent to 86.8% of the population will rec-

ommend that the concept of health checker introduction to improve experience based on sample results of 63% agreeing and remaining 37% agreeing to this point partially .

5. A high correlation of 0.9889 was found between familiarity of concepts and teaching goal accomplishment which means that the students who were familiar with the concepts of the taught softwares were able to learn them better .

6. Overall the programs can be considered as only partially effective as completion rates are low and out of the 3 criteria in only 2 partial fulfillment can be achieved as evident in Table I.

Table I Summary of results related to effectiveness (Source : Primary Data)

Criteria	Effectiveness based on Learning outcomes	Effectiveness based on Customer Satisfaction	Effectiveness based on Teaching components (input/output) effectiveness
Considering completion rates	Partial accomplishment	Partial accomplishment	Poor accomplishment
Without considering completion rates	Partial accomplishment	Partial accomplishment	Good accomplishment

7. As completion rates within the time frame were low so work should be done in order to improve on the reasons for shortfall in effectiveness shown in **Figure 7** .

Scope of Future Research

1.The impact of screen size of laptop/computer of student on the ease of learning can be checked by doing some analysis.

2.The average time taken to resolve problems can be checked program wise and conveyed to students in advance.

3.After the introduction of health checker its impact can be found out on customer expectations etc. Further experiments can be done with the objective to enhance accomplishment of teaching goals, to increase the effectiveness of teaching components.

8.Acknowledgement

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