Recent Trends in Software technology

M. Tech Seminar Report

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by

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Chapter 1

Introduction

The traditional classroom studies are becoming a mundane activity to students nowadays. The students are missing classes which are causing them to lag behind in their course and deviating from the structured flow of the syllabus. But with the technology at hand new methods and techniques are being tried and implemented to improve the scenario. Since technology is playing a key role in our everyday life, so teaching with technology can deepen the learning of students and inspire them. The new technologies allows us to try different things in virtual as well as physical classroom.

In this report the literature survey is done for the different research papers on the methods & technologies which are tried on classroom for different course by some institutes. We will discuss the broad techniques which they are implementing accompanied by the outcomes they observed. We will get to know whether these techniques really gave result in accordance with their hypothesis or not.

These techniques cannot be utilized to its full potential if not implemented properly. In the latter part of the report, how these type of implementations can easily and effectively be produced on device based platform namely on ‘Android’ are being illustrated.
Chapter 2

Flipped Course

In Flipped classroom[1] course instructor uploads the video of course material in specific interval that may be per week or after every class. The students are required to watch those videos regularly at least once after it has been uploaded and before coming to class for that topic. The flip classroom facilitates the student to watch the video at their convenience and their own pace.

The behaviours of students watching the videos can easily be tracked by maintaining the log for every student. Studying these log we can easily evaluate how the students are watching the videos and how it is affecting their performance in course work and class activities.

2.1 Methodology

In this study a CS1 course with 25 videos was selected for getting the students log data for study purposes, which was done for 3 semester. Across the semester the students had to watch every video via web interface before coming to class. The video streaming platform ‘TrACE’ was used. TrACE provided basic video player, it has interface for discussions and most important it included analytics dashboard for instructor to keep log of their video viewing behavior.

Session data was maintained to store interaction of every student with video viz. whether they have watched the video completely or not etc. The main purpose of the study was to get the answer to following questions[1]:

- “To what extent do students actually prepare for class by viewing the video in advance?”
- “To what extent student revisit the course content?”
- “Which viewing behavior co-relates with course performance metrics?”
- “How do student viewing behaviors vary with sociotechnical changes in class?”

Sociotechnical changes refers to the change made by instructor during the course run like student were required to post comment related to video or can ask their doubts so to qualify for participation grade. The interface gave notification for viewing the video before the class.
2.2 Analysis

The metric used were videos viewed, coverage & punctuality. Initially the average no. of students viewing video was less but as the semester progressed it was observed that student increased watching video. It may be due to the sociotechnical changes adapted. Fig 2.1 (a) represents the average student punctuality in hours(y-axis) to video lecture(x-axis) and Fig 2.1 (b) average student visiting the video(y-axis)

![Figure 2.1: Statistical analysis of students viewing behavior [1]](image)

It was observed during first semester that some student watched the video on time and many of them after the class in which they were assigned the video. There were very less student who watched the video again. It may be due to the fact that student does not give that much value to video as the instructor believed. An improvement in performance of was also seen in students who voluntarily watched all the video on time.
Chapter 3

Lightweight Team & Gamification

A new approach was adopted by the institute that made a lightweight team\(^2\) among the students for completing various course task, during the entire course period. Lightweight team means a group of 3-4 student who work together, but it had minimal direct impact on their final grades. So, the effort of the team was focused but it had low stakes.

Gamification means they would create a healthy competitive environment among the teams or individual students. These competition would be associated with some prizes. These games encourages student to work harder. They would also get a sense of collaborative working with their peers.

3.1 Methodology

3.1.1 Lightweight Team

At the start of semester they would make group using moodle’s auto-group function. They also made sure that a group has at least two girl members. To motivate working together they made the students of a team sit together by making seating plan for whole class.

They organize the clicker quiz every week in which every student had to answer a question projected to whole class on screen but they were allowed to have discussion within team. A quick evaluation was done to check whether majority of students are getting the right answer. If not then the teams were told to convince other teams that their answer is right. Through this inter-team interaction were also done.

3.1.2 Gamification

Students were given stamps for small achievements like posting queries, completing bonus question etc and for every 10 stamps collected they would get an 1\% increase in their overall grade. The total stamps for a team was also put up on leader board so peers of same team will encourage each other to collect more stamp as top 3 from leader board was awarded special prize at the end.
3.2 Results

The anonymous survey report were taken from student to get their views on this technique, on how they feel about the different aspect of this method of learning. The survey consists of question which they have 3 options to answer having scale 1= strongly disagree, 3 = neutral, 5 = strongly agree. These are the average score of all the students. The Fig 3.1 shows the question that were asked in the survey and their average score.

<table>
<thead>
<tr>
<th>ID</th>
<th>Agreement Statement</th>
<th>Fall 2013 Early</th>
<th>Fall 2013 Late</th>
<th>Spring 2014 Early</th>
<th>Spring 2014 Late</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flipped</td>
<td>The flipped structure of this class is working well for me (I am learning a lot).</td>
<td>3.17</td>
<td>3.76</td>
<td>3.76</td>
<td>4.05</td>
<td>3.69</td>
</tr>
<tr>
<td>Team-1</td>
<td>Working with my team members to answer clicker questions helps me to learn.</td>
<td>4.54</td>
<td>4.38</td>
<td>4.52</td>
<td>4.60</td>
<td>4.51</td>
</tr>
<tr>
<td>Team-2</td>
<td>The team aspect of the course makes the course overall more engaging.</td>
<td>4.11</td>
<td>3.96</td>
<td>4.22</td>
<td>4.28</td>
<td>4.14</td>
</tr>
<tr>
<td>Team-3</td>
<td>I like being part of a team and sitting with my team each week.</td>
<td>4.28</td>
<td>4.44</td>
<td>4.26</td>
<td>4.48</td>
<td>4.37</td>
</tr>
<tr>
<td>Stamp-1</td>
<td>Stamps provide a good incentive to get me to put more effort into this course.</td>
<td>3.26</td>
<td>3.07</td>
<td>4.00</td>
<td>3.75</td>
<td>3.52</td>
</tr>
<tr>
<td>Stamp-2</td>
<td>The leaderboard on Moodle showing which team has the most stamps adds to my desire to earn more stamps.</td>
<td>3.47</td>
<td>3.04</td>
<td>3.75</td>
<td>3.37</td>
<td>3.41</td>
</tr>
<tr>
<td>Stamp-3</td>
<td>The addition of 1% to my final grade for every 10 stamps earned adds to my desire to earn more stamps.</td>
<td>3.53</td>
<td></td>
<td></td>
<td>3.91</td>
<td>3.72</td>
</tr>
<tr>
<td>Token-1</td>
<td>The use of tokens makes me try hard to figure out the lab with my partner.</td>
<td>3.54</td>
<td>3.07</td>
<td>3.72</td>
<td>3.37</td>
<td>3.38</td>
</tr>
<tr>
<td>Token-2</td>
<td>The tokens are fun and cool.</td>
<td>2.65</td>
<td>2.80</td>
<td>3.56</td>
<td>3.36</td>
<td>3.02</td>
</tr>
<tr>
<td>Token-3</td>
<td>Because the tokens I am becoming a more self-reliant learner.</td>
<td>2.85</td>
<td>2.86</td>
<td>3.47</td>
<td>3.09</td>
<td>3.03</td>
</tr>
<tr>
<td>Token-4</td>
<td>The potential loss of a token has discouraged me from asking for help, even when I really need it.</td>
<td>3.93</td>
<td></td>
<td></td>
<td>3.30</td>
<td>3.72</td>
</tr>
<tr>
<td>Overall</td>
<td>Because of this course, I am likely to take another programming course.</td>
<td>3.89</td>
<td></td>
<td></td>
<td>3.95</td>
<td>3.92</td>
</tr>
</tbody>
</table>

Figure 3.1: Survey Results Average scores [2]

The student who took this course and went on to take the other programming course it was observed that these student perform better in that course as compared to student who didn’t took this course. This also improved the social interaction between the students as more number of student were making new friends. This may help them become connected to community.
Chapter 4

Pop Quizzes

Pop quizzes[3] are unannounced or surprise quiz taken by instructor to get indirect feedback from students on how they are covering the course. These quizzes are also meant to help student in generating self awareness and to check themselves for the progress they have made in course. Pop quizzes also helps student to regularly attend the class as the marks of pop quizzes are added in final grade.

These quizzes enforces students to learn with the course flow which makes them easier to finally prepare for exams. The instructor does not have to explicitly factor for the attendance in semester grade relieving them from one burden.

4.1 Methodology

In this study 9 sections of basic CS1 course were taken into consideration, out of which 6 were given pop quiz and 3 were not. The students taking this course were from 13 different majors and had different academic year. In all the section the course was taken by same instructor. The course flow was also same for all section i.e. content and sequence of the topics. The only difference was that of pop quiz and other being distribution of marks for final grade but that doesn’t really effected the study.

4.2 Results

When comparing the results of students of different academic year it was found that students of underclassmen i.e. freshers and sophomore benefited the most from this, but there was no significant improvement in senior students. It may be because the senior student are more matured and discipline in studying as they have more experience.

Out of students from different majors it was noticed that students of CS/IS major scored nearly 12 points more on exams. Mathematics were also a dominant group in which statistical difference was seen of around 7 points. There was no significant difference in performance of student from other majors. Pop quizzes also reduced the withdrawal rate of course and increased the rate of students passing the course.
Chapter 5

Development Techniques & Tools

The implementation of a technology, idea or method as a software application is a complex task. It is crucial that process of development of these application is done as per the requirements and with optimal amount of resources allocated.

In this report mostly the topics will be related to android development only, but some of these can be generalised to perform on other developmental process also.

5.1 Android Performance

When working and developing an app optimum android performance is a must. For requirements to be fulfilled trade off should not be done with performance. It should be kept in mind that every method or function should be optimized. Even a small issue on the code may lead to tiny laggy experience, which is not liked by anyone. These are some of the areas where the problem may arise.

Figure 5.1: Android’s rendering pipeline with common problems & solutions [4]
Rendering

The process of generating image (or UI in this case) from program is known as rendering. During rendering CPU & GPU works together to draw image on screen. Android try to render a frame from the code for animation every 16ms so if we miss this window to update the screen it drops a frame leading to a lag. So all updating should be done within the 16ms time window to get proper output.

Computation

It may happen that some of the functions are taking more time than expected. To identify that we can easily use the ‘Trace View’ an in built tool in Android Studio which helps us in profiling the methods which are taking time. After that we can identify and reduce the computation. There are many generalised methods to reduce computation time like batching, caching and selection of proper data structure.

Memory

Android manages its memory by doing garbage collection. So when making app in android many developer tends to forget about the memory usage but it comes with a catch. Since app will allocate memory as and when its needed, so it will reach its quota frequently forcing the android to do garbage collection more often which takes its own time and making the app slower. So to avoid this we must identify memory leak on our app i.e. deallocate the memory properly when its use is over. We should also avoid memory churn, allocation of lots of object in short amount of time.

5.2 Google Analytics for Android

Google provides many pre-build API/Services e.g. Google Ads, Google Locations, Google drive and many more which one can easily import in their project to make use of it. We just have to be registered in console.developers.google.com to get authentication and authorisation then we can use the services we want. Fig 5.2 displays a basic model through which we can request for services.

Here we will discuss about Google Analytics for android which is used to keep the track of our app. Google Analytics provides a dashboard through which we can get to know how people are using our app. It shows the number of new and total user which are using our app. We can get to know in which part of the world people are using the app and get the actual number of people also. It can tell us the devices that are being used by the people to run our app. The most important functions for which analytics is used for are tracking real time data and Tag manager.

The real time tracking of app let us do screen and event tracking, we can track the details of specific screen and see what user are doing in app mostly. We can check whether the goal of the app is being completed or not. It can also track e-commerce of our app and let us know if user are spending money. It also stores crash and exception that may arise during the usage of the app. It provides the response time of different part of our app.
Through Tag manager we can also send our customized data to analytics these are called tags. We can track events or hits inside the app. The most important use of tag manager is to dynamically update the app without the need to redeploy our app. Trigger can also be defined to perform different task according to users actions.

5.3 A/B Testing

A/B testing is a process of comparison of two version of an application with properly defined metrics to see which version is performing better. The versions should not be different altogether, it should be such that there are some small difference on both version but which are noticeable for comparison. The goal of A/B testing is to get a product or feature which is liked by mostly and is a winner. Through A/B testing we can determine whether to apply the changes or not.

A/B testing helps us to make more out of the existing features. But when doing this testing certain protocols has to be followed, one cannot just jump to testing without proper planning. It includes the following steps.

Figure 5.3: A/B Testing of an application [5]
Policy & Ethics for Experiments

When conducting A/B testing we have see whether the experiments would effect the users in anyway or not. There are factors which should be kept in mind while doing the experiments like minimal risk to which user are being exposed to. What are the benefits that might come, whether the result will be use-full. What are the other choices do user have. Most important is privacy, it may be that we are gathering some personal data related to their activity. So it is of utmost importance that no data may be leaked.

Choosing & Characterising Metrics

Choosing and deciding on a metric is most important part as it is the feature on which the two version is going to get compared. The metric should be properly defined and it should be clear what are the mathematical process that one needs to do. The metric must fulfill the objective of the test. For example if we want to know the conversion rate of a button on UI we assume the metrics as click through rate which is simple and efficient. The metrics can be combined to form a single metric also. Generic metrics should be made so that it can be reused in multiple instance rather than making a optimized metric for single objective.

Designing an Experiments

When designing a experiments it should be clear what we are going to speculate. A proper hypothesis must be formed. Proper duration of the experiment must be set. In certain scenario we may have to decide the subject of the experiments i.e. amount of user or a particular group of user.

Analyzing Results

Analyze the test results and see which version perform gives more better results. If there is significant difference in result you can implement it straight forward but if the results are inconclusive you may have to repeat the whole process.

5.4 Tooling & Automation

The development process can be made lot quicker and convenient if proper tools are used. It saves lot of time and effort if automatic optimization is done by creating proper environment according to your development needs. Its worthless to do something from scratch if proper a API is present which can be effectively used. Optimization is foremost priority but its vain if for an optimization you have to spend more time than required.
Build Tools

Build tools are programs that automates many of the intermediate process which are required to be done multiple times during development and execution of applications. Compilation, linking and packaging are some of these steps. When choosing a build tools some important points should be kept in mind like:

Fast  It should be fast on execution so changes can be seen quickly

Community Driven  More people should be using it so any problem can be addressed to get solution quickly

Extensible  It must be able to support custom functionality so it can be added when required
After reading different research paper we get to know that effective ideas and techniques can help a lot in changing current scenario of learning in class. It has been observed that adapting these methods has improved the effectiveness of study among students. Students participating in these experiments have performed and scored well comparing to the students who were not.

Through these development techniques we can easily implement and effectively reproduce the result of many of these methods. These learning can also be applied in "SAFE" Quiz App as a part of MTP.
Bibliography


