USER ENGAGEMENT AND PREFERRED VIDEO STYLE IDENTIFICATION

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September 2019

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Dissertation submitted in partial fulfillment of the requirements for the Bachelor of Science Special (Honors) Degree in Information Technology

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. Also, I hereby grant to Sri Lanka Institute of Information Technology the non-exclusive right to reproduce and distribute my dissertation in whole or part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as article or books).

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The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

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ABSTRACT

Massive Open Online Courses have come to the spotlight for their openness and scale. A clear majority of services that offer MOOCs like Coursera, Edx and search engine platforms like Class Central play a great role in recommending MOOCs to their users. However, the problem revolves around MOOCs users' course dropout rate being gradually high even though the recommendation is derived based on the courses that were followed previously. Hence, the requirement to come up with a more precise and elegant way to identify a person's individual learning style(s) and cover a broad range of MOOC video styles in order to reduce the MOOCs course follower dropout rate and to increase the number of individual learning styles that can be supported by MOOCRec V2 service, was arisen.

In 'Identifying user's preferred learning style phase, the system displays an interactive introductory session which consists of all MOOCs learning material types that are recognized by the proposed system such as animations, talking head, presentation slides, etc. that are suitable for all types of learners. This session is designed by using HCI techniques in making the session easy to understand and straightforward. During this session, by using analytical HCI techniques such as mouse motion, getting user ratings, dropdown point analysis, etc. system determines during which phase of the interactive video session, the user was mostly engaged with the system. By doing so, we are left with a sizable amount of information about the engagement of the user across multiple video production styles that belong to different learning dimensions. Using this information, the application predicts the video production style(s) that is in tune with the user's learning dimension. This prediction result is derived through a decision-making algorithm. Finally, user's preferred learning style is identified by carrying out a mapping of MOOCs with FSLSM.

However, end product is solely targeted for any e-learner who is interested in knowing their preferred learning material type in order to receive an interesting and an enduring e-learning experience and as a platform for any MOOCs user to be aware of which type of a learner they are.

Keywords: MOOCs, FSLSM, HCI, Introductory Video

ACKNOWLEDGEMENT

This academic thesis and work described in it were conducted as a part of 4th year research module (Comprehensive Design Analysis Project) under the degree program BSc (Hons) in Software Engineering in Sri Lanka Institute of Information Technology. The fruition of this research and the associated software project are results of dedication of the 4 group members and the immense support given by a supervising panel.

Thus, we would like to express our gratitude towards Dr. Nuwan Kodagoda and Ms. Kushanara Suriyawansa, who are our supervisors as well as lecturers of Sri Lanka Institute of Information Technology. Completion of this academic work would not have been possible without their guidance and insight. We are extremely grateful to Dr. Malitha Wijesundara and Dr. Dasuni Nawinna, who reviewed and approved our research topic and provided valuable suggestions. Furthermore, we wish to express our gratitude to Mr. Jayantha Amaraarachchi, the Head of SLIIT Centre for Research who provided us with immense knowledge and guidance throughout.

Also, we would like to express our gratitude to all our colleagues and companions who helped us in testing and in various other ways to make our research come to fruition. At the same time, we would like to thank everyone who might not have been mentioned but has given their support and encouragement to us.

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Table 0.1:List of Abbreviation

MOOC	Massive Open Online Course
ILS	Index of Learning Styles
FSLSM	Felder Silverman Learning Style Model
HCI	Human Computer interaction

1. INTRODUCTION

1.1. Background Literature

While MOOCs are ever so popular among the mass crowds, the completion rate of MOOCs has been found out to be low by many researches done on the engagement of consumers with MOOCs over the duration of courses[1]. Furthermore, pioneering researches such as Felder-Silverman Learning Style Model [2]has highlighted the importance of acknowledging that an individual can inherit a learning style or few that he or she will be more inclined towards and dimensions that an individual can fall into, such as Active or Reflective, Visual or Verbal, Sensory or Intuitive, Sequential or Global. This is another factor that cannot be overseen when recommending MOOCs to an individual since a certain type of MOOCs can appeal to a certain dimension.

Upon further investigation, it was realized that Index of Learning Styles (ILS) Questionnaire [2] [3] exists to determine the dimension that an individual fit into, from the aforementioned set of learner dimensions [4], devised by Richard M. Felder and Barbara A. Soloman [4]. Another interesting fact about this Questionnaire is that it is a lengthy Questionnaire that consists 44 multiple choice questions [5][4]. Further it is proven that longer questionnaires have lower response rates by Micheal J.Roszkowski and Andrew G.Bean [6]. However, based on a survey conducted the overwhelming majority of the participants appeared discouraged to fill 44 questions. It is the conclusion of the aforementioned survey that led us to research a better solution to identify the learning-dimension/style of an individual.

Moreover, Petteri Nurmi and Tei Laine states that through User Modeling, we can find the goals, knowledge background, traits, context of work and also the interests of a user who interacts with a system [7]. That's where HCI, which is used for user modeling comes into consideration. Further it is said that, using an Analytical Model, a system can simulate the cognitive process that carries out while a user interacts with a system [8]. Hence it explains that given user's engagement to a specific web content can be analyzed by using on screen HCI Analytical

Techniques such as mouse hover, scroll, rate to content, flip, and skip watching the content and such by User Experience of On-Screen Interaction Techniques research done in 2013 [8].

With more investigation, it is found that a two-dimensional mapping which is prepared considering learning style characteristics and MOOCs characteristics exist [3] in order to help decide, which learning material type suits which learning style., i.e. if a MOOC video contains a given percentage of a talking head video style, then the MOOC video is more likely suitable for an intuitive, verbal and global learner [3].

Therefore, based on above facts, it was concluded that based on human computer interaction techniques, we can identify how engaged that individual is, with the given task. Furthermore, by providing an interactive, yet concise session that contains MOOC related videos that belong to different learning-dimensions by considering the aforementioned learning material type to learning style mapping, we can effectively identify to which learning-dimension that an individual will fall into by identifying the learning-dimension of the MOOC video during which, the individual showed the highest engagement based on HCI techniques.

1.2. Research Gap

Class Central, which is a top MOOCs provider available in the e-learning industry recommends one's desired video style by the field of study that they are interested in. Further, they prompt the user to select the course provider and the university that they prefer, in order to receive recommendations from the respective choice they make. Also, there's a limitation where user has to select five or more areas that they prefer in order to proceed, which can be mentioned as an unnecessary effort for learners. Yet, one's learning style is not identified as well as user's preferred way of learning the specific field of study is not identified.

My MOOC, which can be recognized as another major e-learning platform, provides MOOC recommendations by letting user search MOOCs as per their need. On the other hand, user can also select the subject area (e.g.: Science) that

they want to follow up, and also, they can select the sub categories (e.g.: Chemistry). Other than that user needs to search for their preferred video style to learn the specific subject area.

MOOCRec was a MOOCs recommender system that was introduced by targeting several drawbacks of the aforementioned leading e-learning platforms. In MOOCRec system, user's preferred learning style is identified by providing the user with an ILS questionnaire which consists of 40 questions. Depending on the results the system provides recommendations. But the drawback of the system was providing the user with a lengthy questionnaire in order to serve user with recommendations which match their needs.

Henceforth, by considering above facts, MOOCRec V2, which is an extension of MOOCRec is designed in a way that user experience is taken into consideration, thus providing an interactive introductory video session to conclude user's preferred leaning material type and also to provide the user future recommendations based on the interactive session's engagement results which takes a shorter period of time than filling ISK questionnaire.

1.3. Research Problem

As more and more people across the world adopt e-learning platforms to increase their knowledge and gain certifications, Massive Open Online Courses have come to the spotlight for their openness and scale. Along with that, search engines and review sites solely focusing on MOOCs emerged to help people find MOOCs that belong their field of study easily.

However, the clear majority of services that offer MOOCs like Coursera, Edx and search engine platforms like Class Central only take a person’s interest in a certain field of study or a certification into account when filtering or recommending MOOCs. However, a service called MOOCRec has bridged this gap between finding a MOOC that not only matches a person’s field of study but also their personal learning style. Furthermore, MOOCs belong to a wide range of video

styles in which they are delivered such as animations, presentation slides, etc. This present a dilemma to a consumer as to which MOOC to choose since some video styles may appeal to a consumer more than the other.

While MOOCRec achieves many aspects of providing personalized recommendations based on individual learning styles, we have found a set of areas where the approaches can be further improved while introducing a new set of features to solidify the recommendation process by factoring in sentiments of MOOC consumers. To elaborate further, we identified that we can improve upon the process of identifying the individual learning style of a person which is done in terms of a lengthy Questionnaire in the existing product, MOOCRec V1.

Therefore, our research problem revolves around coming up with a more precise and elegant way to identify a person's individual learning style(s) and cover a broad range of MOOC video styles in order to increase the number of individual learning styles that can be supported by MOOCRec V2 service.

1.4. Research Objectives

1.4.1 General Objectives

The main objectives of Identifying users' preferred learning material type module can be outlined as follows;

- Help users identify their individual preferred learning material types in order to retain their interest in MOOCs.
- Help MOOCRec V1 users reduce the time of filling ILS questionnaire in order to find their preferred learning style, thus providing an alternative approach to find preferred learning style.

1.4.2 Specific Objectives

To achieve aforementioned general objectives, we have identified a range of specific objectives that have to be achieved in order to bring our solution, which is MOOCRec V2 to fulfilment.

- Implementation of a HTML5 video player to showcase an interactive, engaging, video-based tutorial that is short and specific.
- Implementation of event listeners to capture Human Computer Interactions when user follows up with the interactive segment.
- Introduction of learning material type to learning style mapping.
- Implementation of learning style and learning type decision making algorithms.

2. METHODOLOGY

2.1. Methodology

To identify user's learning style in a more practical manner, MOOCRec V2 is replacing the ILS questionnaire which helped user identify the learning style with an introductory video which will be identifying user's preference by tracking Human Computer Interaction. In 'Identifying user's preferred learning material type of a MOOCs user through HCI techniques phase, the system displays an interactive introductory video session which consists of all MOOCs learning material types that are recognized by the proposed system namely animations, talking head, presentation slides, khan academy writing, code/tutorial that are suitable for all types of learners. These videos are of same duration and of same subject weight [Figure 2.1].

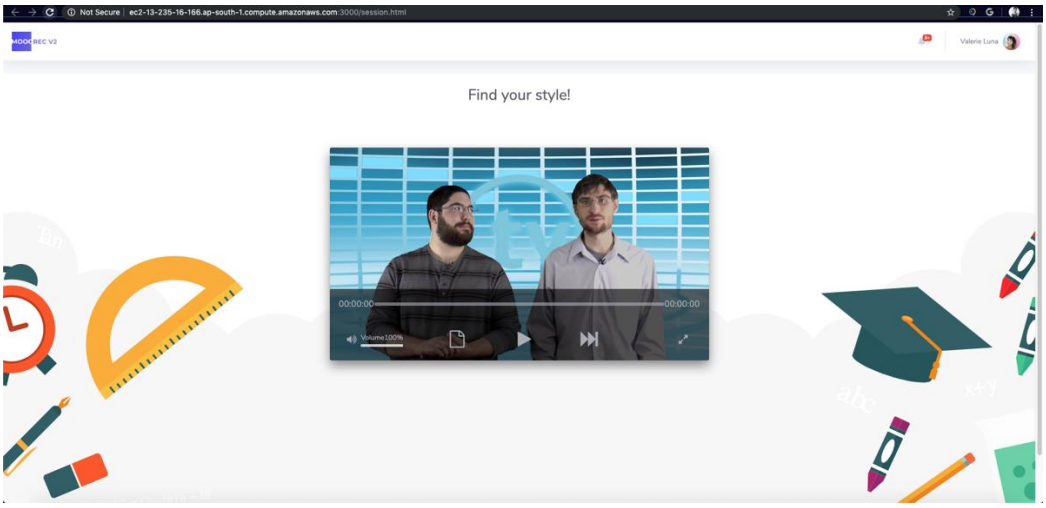

Figure 2.1:Intro Video

Our HTML 5 video player is designed in a way where users can play, pause, skip to next video, replay the same video, skim through video as well as rate the video content. Furthermore, the HTML player is designed adopting HCI techniques such as affordance, constraints, attention and workload models. During this session, we collect user feedback by using analytical HCI techniques such as dropdown point analysis, skim through rate, getting user ratings, mouse scroll motion captures (for transcript viewing), button clicks, etc. [Figure 2.2]

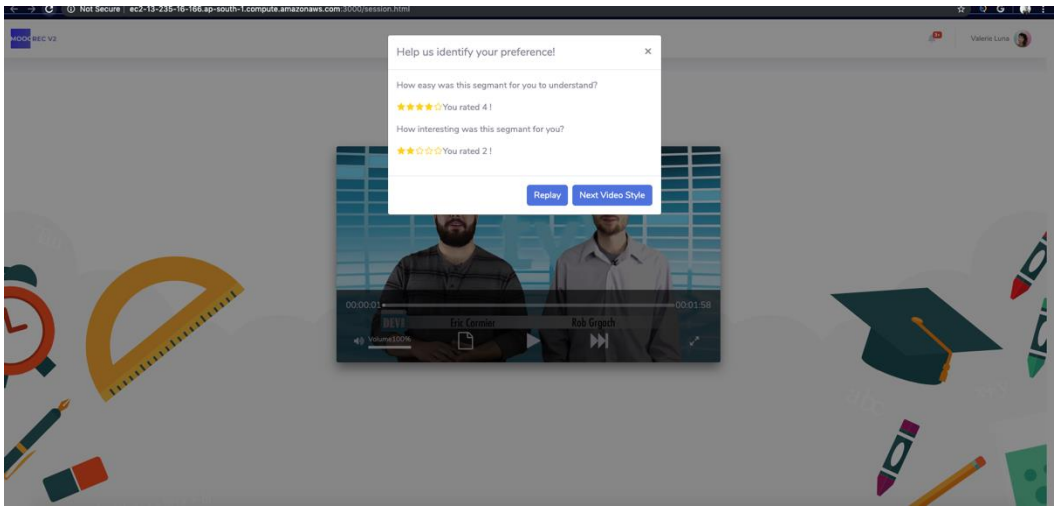

Figure 2.2: HCI Ratings

Moreover, each user interface related to video session has to be verified using HCI techniques to see whether following goals are achieved.

- User is aware of the interactive elements
- Interactive elements represent the input needed from the user clearly
- Interactive area is smooth, and responsive
- Interactive area adapts to the video style that is playing at the moment

As a result, our algorithm determines, during which phase of the interactive video session, the user was mostly engaged with the system. By doing so, we are left with a sizable amount of information about the engagement of the user across multiple video production styles that belong to different learning dimensions. Using this information, the application predicts the video production style(s) that is in tune with the user's learning dimension. To determine the corresponding learning style for a given video style, we carry out a mapping of MOOCs with FSLSM (a video style to learning style mapping) which was derived through literature review [Table 2.1].

Table 2.1: Learning-Dimension to Video Style Mapping based on FSLM

	Talking Head	Animation	Code/ Tutorial	Presentation slides	Khan academy writing
Sensory			✔	✔	✔
Intuitive	✔	✔			
Visual		✔		✔	✔
Verbal	✔		✔	✔	✔
Active		✔	✔		
Reflective				✔	

Sequential			✔	✔	
Global	✔	✔			

Finally, the preferred learning material type prediction result is derived through a decision- making algorithm.

Consider a single segment(i) in the interactive session.

$$A = \left[\frac{\Delta t_i}{T} * 1 \right] \quad (1)$$

$$where\ \Delta t_i\ is\ the\ watched\ duration\ of\ segment\ i$$
$$and\ T\ is\ the\ total\ lenght\ of\ that\ segment$$

$$B = [\ \Sigma(P_{n)} * 1\ ] \quad (2)$$

$$where\ P_n\ represent\ an\ action\ in\ segment\ i$$

$$C\ =\ Q_1 +\ Q_2 \quad (3)$$

$$where\ Q\ represent\ a\ question\ asked\ in\ the\ segment\ i$$

$$\boldsymbol{Score(S_i) = A + B + C} \quad (4)$$

By adding the positive points gained by positive interactions and the ratings provided by the consumer at the end of each segment, as well as the negative points gained by skipping, seeking through the segments, we can give a final score to each segment that represent how positively engaged, the consumer was, with the session [Figure 2.3].

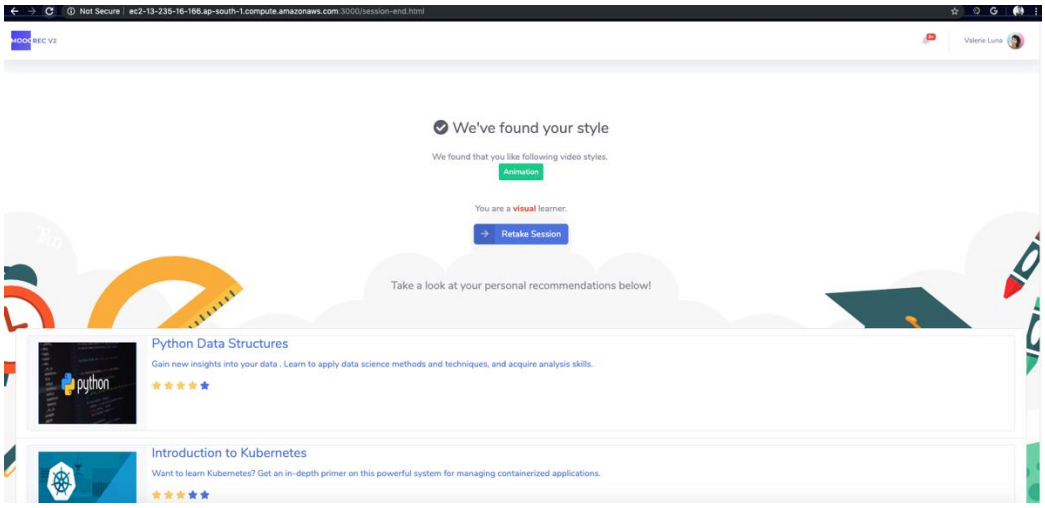

Figure 2.3: Intro Video Results

This whole process of identifying users' preferred learning material type component is graphically illustrated in [Figure 2.4].

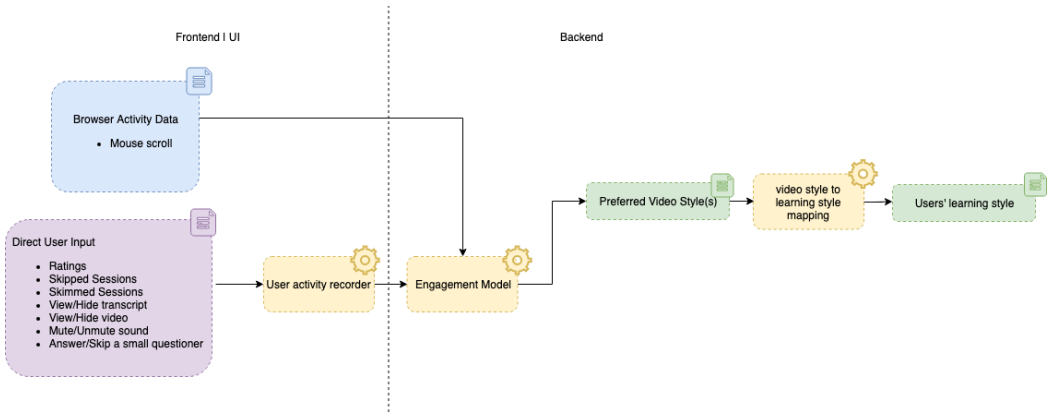

Figure 2.4:Design Diagram-Identifying Preferred Video Style

2.2. Testing & Implementation

Pre-conditions:

- Users who are participating for all test should be the same individuals.
- Users should have their maximum concentration on the test to make it a success.

- Test environment should be free of external disturbances.
- There cannot be unexpected interruptions during the test.

Assumptions:

- Test is conducted under the assumption of users being honest with their provided answers.
- Test is conducted under the assumption of users being actively interactive with the system.

Test participant details:

- Number of participants for each test: 10
- Age: 20-25 years
- Education: Information Technology Undergraduate
- Education Institute: SLIIT

- Test 01 - Validate users' own preference with system's suggested preference.

  Step 1: Letting the sample set of users freely share with us their preferred learning material type(s) after actively interacting with our interactive introductory segment.

  HCI technique used: Think Aloud.

  Step 2: Letting the same sample set of users actively interact with our interactive introductory segment and get the final result suggested by our system.

  HCI technique used: Experimental Evaluation.

  Step3: Analyze if the engagement-level predictions made for each user by the system is equal to the learning material type(s) that the user freely selected initially in Test 1 Step 1.

- Test 02 - Validate FSLSM to Video Style Mapping.

  Step 1: Letting the same sample set of users fill the ILS questionnaire to identify their learning style and allow them to interact with our introductory segment.

  HCI technique used: Questionnaire.

  Step 2: Letting the same sample set of users actively interact with our interactive introductory segment and get the final result suggested by our system.

  HCI technique used: Experimental Evaluation.

  Step 3: Analyze if the ILS questionnaire result is equal to the result provided by the system in order to validate our proposed MOOC learning material-to-FSLSM mapping.

- Test 03 – Compare the time taken to fill ILS questionnaire and the time taken for an average person to complete interactive session.

  Step 1: Letting the same sample set of users fill the ILS questionnaire to identify their learning style and allow them to interact with our introductory segment while recording the time taken to fill the questionnaire with a stopwatch.

  Step 2: Letting the same sample set of users actively interact with our interactive introductory segment to get the final result suggested by our system while recording the time taken to fill the questionnaire with a stopwatch.

  Step 3: Compare the time taken for an average person to fill ILS questionnaire and the time taken for an average person to complete interactive session.

3. RESULTS & DISCUSSION

3.1. Results

The results of the computations and evaluation techniques used are shown below.

Table 3.1: Test 01

Test Number 01		
User	**User's preferred video style**	**System Suggestion**
User 1	Animation	Animation
User 2	Talking Head	Animation
User 3	Talking Head	Talking Head
User 4	Presentation Slides	Presentation Slides
User 5	Presentation Slides	Presentation Slides
User 6	Animation	Animation
User 7	Code	Presentation Slides
User 8	Talking Head	Talking Head
User 9	Animation	Animation
User 10	Animation	Animation

Table 3.2: Results of Test 01

Evaluation Criteria	Validate users' own preference with system's suggested preference.
HCI Evaluation Technique(s) Used	Think Aloud, Experimental Evaluation

Test group	IT Undergraduates of age 20-25 years
Number of testers	10
Success (%)	80%
Failure (%)	20%

Table 3.3: Test 02

Test Number 02				
User	**User's preferred video style recommended by MOOCRec v2**	**Learner types suggested by FSLSM to video style mapping**	**Learner types suggested by ILS questionnaire (Listed from highest to lowest score)**	**Mapping success fraction**
User 1	Animation	Intuitive Visual Global	Intuitive Global Visual Active	3/4
User 2	Animation	Intuitive Visual Global	Reflective Sequential Sensory Active	0/4
User 3	Talking Head	Intuitive Verbal Global	Visual Active Sensory Sequential	0/4
User 4	Presentation Slides	Sensory Visual Verbal Reflective Sequential	Global Visual Intuitive Active	1/4

User 5	Presentation Slides	Sensory Visual Verbal Reflective Sequential	Visual Intuitive Reflective Sensory	3/4
User 6	Animation	Intuitive Visual Global	Active Visual Sensory Global	2/4
User 7	Presentation Slides	Sensory Visual Verbal Reflective Sequential	Active Global Verbal Intuitive	1/4
User 8	Talking Head	Intuitive Verbal Global	Active Sensory Reflective Sequential	0/4
User 9	Animation	Intuitive Visual Global	Verbal Sensory Sequential Active	0/4
User 10	Animation	Intuitive Visual Global	Active Sequential Reflective Verbal	0/4

Table 3.4: Results of Test 02

Evaluation Criteria	Validate FSLSM to Video Style Mapping.
HCI Evaluation Technique(s) Used	Think Aloud, Questionnaire
Test group	IT Undergraduates of age 20-25 years

Number of testers	10
Success (%)	25%
Failure (%)	75%

Table 3.5: Test 03

Test Number 03		
User	**Time taken to complete intro session (seconds)**	**Time taken to fill ILS questionnaire (seconds)**
User 1	312	1200
User 2	600	900
User 3	501.6	1500
User 4	571.2	1155
User 5	502.2	1261.2
User 6	455.4	1830
User 7	375	1265.4
User 8	503.6	1503.6
User 9	452.4	1080.6
User 10	367.2	1116

Table 3.6: Results of Test 03

Evaluation Criteria	Compare the time taken to fill ILS questionnaire and the time taken for an average person to complete interactive session.
Time measurement tool	Stop watch
Test group	IT Undergraduates of age 20-25 years
Number of testers	10

Time taken to fill ILS questionnaire per tester	21.353 minutes / 1,281.18 seconds
Time taken to complete intro session per tester	7.734 minutes / 464.06 seconds

3.2. Research Findings

According to the aforementioned results which were found during the testing and evaluation phase of MOOCRec V2, it was found that the attempt of mapping FSLSM with video styles was not a massive success since the success percentage was only 25% whereas the failure percentage was 75%.

Furthermore, it was found that MOOCRec V2 is successfully able to conquer and provide 80% accurate suggestions regarding one's preferred MOOCs video style. Apart from that, the attempt of designing an introductory session to identify one's preferred video style within a shorter period of time, rather than spending a lot of time in order to complete ILS questionnaire turned out to be a success.

3.3. Discussion

MOOCRec V2's Identifying Users' Preferred Learning Material Type was evaluated in three aspects namely validating users' own preference with system's suggested preference, validating FSLSM to video style mapping and comparing the time taken to fill ILS questionnaire and the time taken for an average person to complete interactive session. While the first two evaluations appeared to be a great success, the FSLSM to video style mapping appeared to be a less successful attempt.

The FSLSM to video style mapping can be further improved by introducing new learning material types. Moreover, the prediction algorithm also can be further improved by taking more HCI aspects into consideration when deriving which learner style, a user belongs to.

4. CONCLUSION

While there are MOOC search engines such as Class Central, MyMOOC that search across multiple MOOC providers as well as search functionalities provided by MOOC providers themselves, it is important to note that these search engines consider the area of study and keywords to produce recommendations. But, to address the issue where consumers lose their interest, one clear solution is to provide MOOCs that resonate with their preference of video style and user experience. MOOCRec V2 is designed to address these ongoing issues, in order to uplift the rate of completion of MOOCs. MOOCRec V2 service is designed to identify how engaged a consumer with each of the 6 major video production styles. This unique combination of identifying consumer's engagement, the service is capable of generating highly personalized recommendations for the consumers.

5. REFERENCES

[1] M. Khalil, "Learning Analytics in Massive Open Online Courses," no. April, 2018.

[2] R. M. Felder, "A Longitudinal Study of Engineering Student Performance and Retention. IV. Instructional Methods," J. Eng. Educ., vol. 84, no. 4, pp. 361–367, 1995.

[3] S. A. It, "MOOCREC : Learning styles- oriented MOOCs recommender and search engine department of Software engineering Sri Lanka Institute of Information Technology Sri Lanka MOOCREC : Learning styles- oriented MOOCs ecommender and search engine October 2018," no. October, 2018.

[4] S. Graf, Kinshuk, and Tzu-Chien Liu, "Identifying Learning Styles in Learning Management Systems by Using Indications from Students' Behaviour," 2008.

[5] R. M. Felder and B. A. Soloman, "Index of Learning Styles Questionnaire."

[6] M. J. Roszkowski and A. G. Bean, "Believe it or not ! Longer questionnaires have lower response rates" vol. 4, no. 4, pp. 495–496, 1990.

[7] T. L. Petteri Nurmi, "Presentation: Introduction to User Modeling," p. 25, 2007.

[8] S. S. Sundar, S. Bellur, J. Oh, Q. Xu, and H. Jia, "User Experience of On-Screen Interaction Techniques: An Experimental Investigation of Clicking, Sliding, Zooming, Hovering, Dragging, and Flipping," Human–Computer Interact., vol. 29, no. 2, pp. 109–152, 2014.

6. APPENDICES

Appendix A

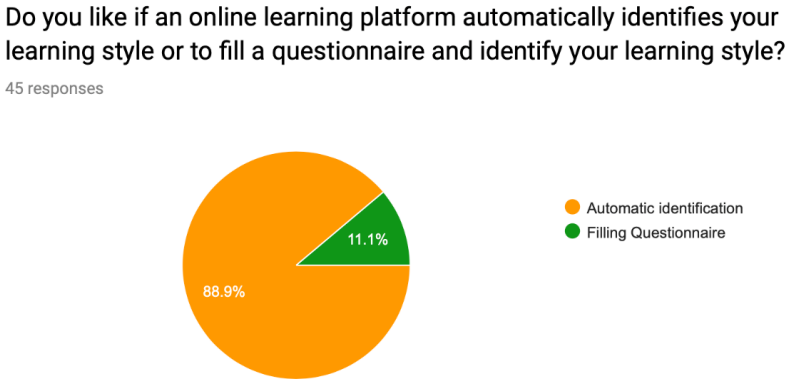

Figure 6.1: Survey on Filling A Questionnaire

Appendix B

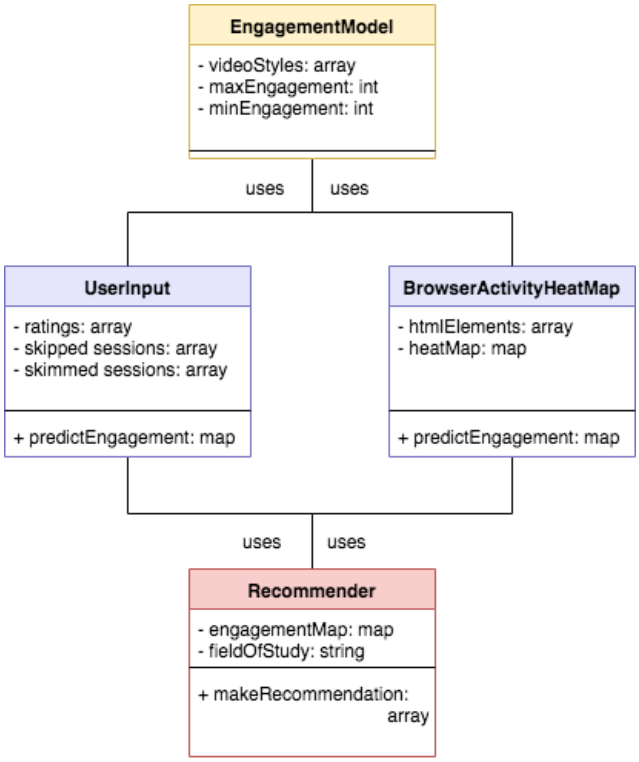

Figure 6.2: Class Diagram

Appendix C

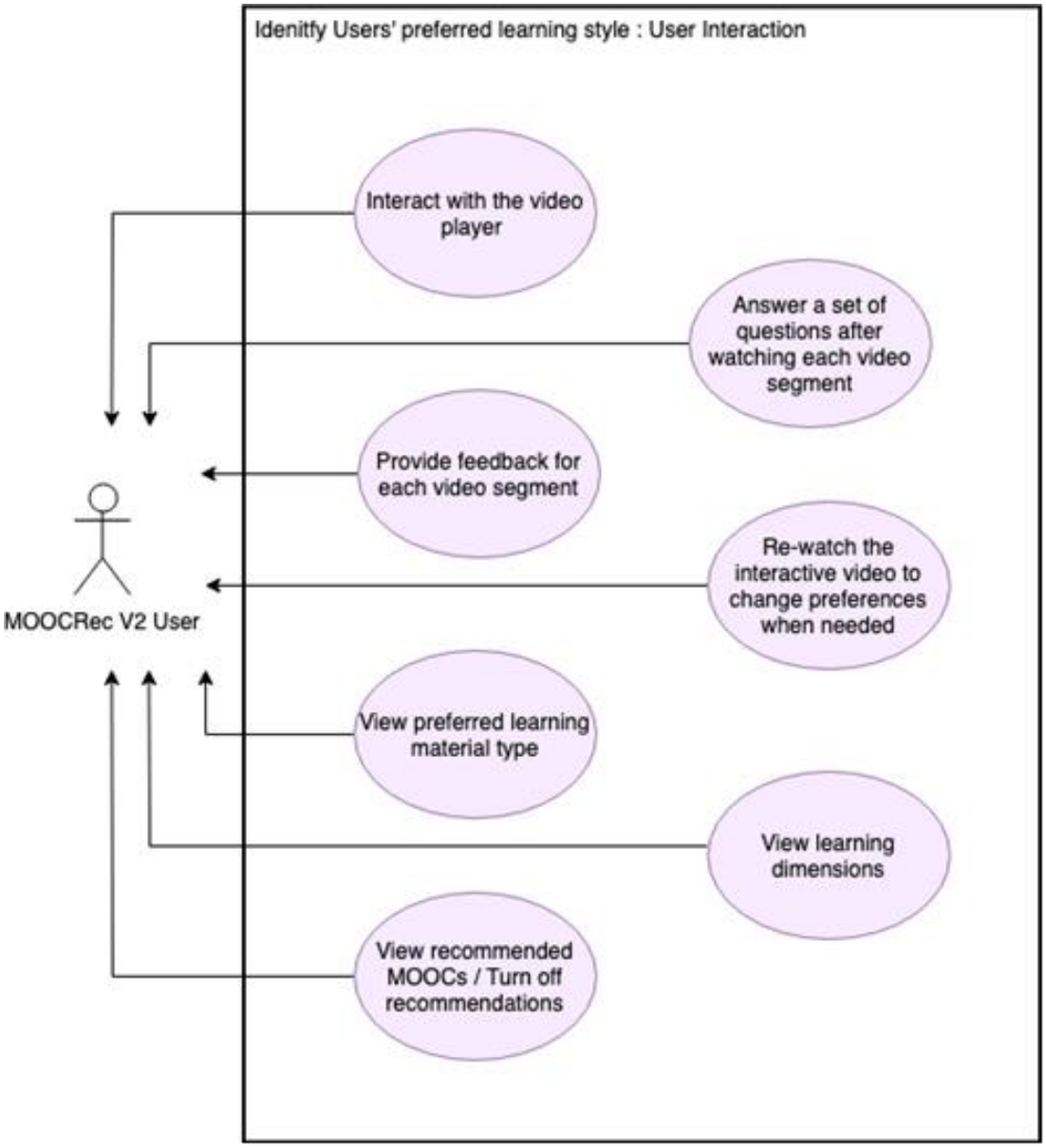

Figure 6.3: Identify Users' Learning Style User Interaction Use Case Diagram

Appendix D

Table 6.1: Use Case Scenario 1

User Case Name	View preferred learning material type
Pre-Condition	User should be logged in
Post-Condition	User should have completed watching the interactive session
Actor	MOOCRec V2 User
Main Success Scenario(s)	1. Watch the interactive introductory video provided by MOOCRec V2 2. Actively participate throughout the video 3. Rate each video segment watched. 4. Answer the given questions after each video segment. 5. Proceed till the end of the interactive session.

Table 6.2: Use Case Scenario 2

User Case Name	Re-watch the interactive video to change preferences when needed
Pre-Condition	User should have already taken part in the interactive session or have skipped the session during initial sign in.
Post-Condition	No post condition
Actor	MOOCRec V2 User
Main Success Scenario(s)	1. User navigates to account settings page. 2. User chooses ‘change my preference’ link 3. User participates to the interactive session.

Table 6.3: Use Case Scenario 3

User Case Name	Interact with the video player
Pre-Condition	User should be logged in.
Post-Condition	No post conditions.
Actor	MOOCRec V2 User

Main Success Scenario(s)	1. User watches the interactive introductory video provided by MOOCRec V2 2. User performs view transcript/ skim through video/ skip video segments/ pause video/ mute sounds/ maximize the video player/ watch subtitles operations.

Table 6.4: Use Case Scenario 4

User Case Name	View learning dimensions
Pre-Condition	User should be logged in.
Post-Condition	User should have completed watching the interactive session and actively participated throughout the session.
Actor	MOOCRec V2 User
Main Success Scenario(s)	1. User watches the interactive introductory video provided by MOOCRec V2 2. User rates each video segment watched. 3. User answers the given questions after each video segment. 4. User proceeds till the end of the interactive session.