Chapter 4 Educational Videos Selection and a Proposed Framework for eLearning

4.0 Introduction

Videos have tremendous potential for education as evidenced by their presence and usage on video sharing sites like YouTube[16], Vimeo[17]. Videos can effectively complement classroom learning, and facilitate self-study at individual pace [98]. It is a known fact that brain responds and processes visual stimuli more effectively than the written or spoken word. In addition, effective demonstration of abstract learning concepts and scientific experiments are best illustrated through the use of videos. Educational videos form a substantial source of information for students [78]. What constitutes an appropriate video depends on the learning requirements, learning goals and the current state of the student's knowledge. As with any other information or knowledge discovery from the Internet, the difficulty is not in locating, but in identifying the ones that meet the learning requirements of students. Guiding students to the right video content is crucial since students in school going age do not possess the necessary skills or the domain knowledge to screen videos relevant to their requirements. Unlike other sectors, in education, the recipient of the information implicitly trusts the content presented to them [6]. This places an additional burden on recommendations to be right. Despite the widespread availability of videos, the challenge for educators is which videos and how are they to be used for enhancing student learning outcomes [98]. The essence of this chapter is to ferret out the *most appropriate* video(s) for students in the K-12 grades.

Since barriers to publishing information on video sharing sites are minimal, as a consequence all types of educational content for any given topic can easily be found. People without possessing suitable qualifications, domain background do upload content to the web. For content published in the form of books, there are numerous checks and balances ensuring that the information presented is reliable and can be trusted. For example, for school books, there are expert reviewers and bodies accrediting the publishers and their content. Sadly due to

[16] https://www.youtube.com/
[17] https://vimeo.com/

the nature of the Internet assurance of quality and authenticity is neither present nor a feasible option. As a result, a video sharing site like YouTube tends to be a repository of videos in education ranking from high-quality sources like Khan Academy[18] to videos by tutorials promoting their business. With the explosive growth of educational content and the availability of good quality educational videos, there is scope for tailoring experience using publicly videos available. It is a cumbersome task to have videos selected by experts manually due to the time, effort and possible costs involved. In view of the above constraints, alternate approaches for ensuring that the right content relevant to the users need is probed.

YouTube alone is said to account for about twenty percent of the web traffic [99]. With almost three hundred hours of videos being uploaded per minute on YouTube [72], there is a significant motivation and necessity to assist students in their quest for appropriate videos for learning. Users locate videos by search words or based on hosting sites recommendations of related content [72]. Having students search, browse and locate the most suitable video is not only time consuming but also places a cognitive burden a vast majority are ill-equipped to handle. Video searching is particularly problematic since users are generally unsure of what keywords to use for searching. This has been mostly attributed to insufficient metadata associated with videos. Most of the videos are accompanied by a title followed by sparse metadata. As a consequence users tend to select videos based on search results ranking, popularity, topicality, gut feel or based on YouTube proprietary recommendation algorithm [5][6]. Also, users are known to sort out the videos by watching brief snippets using a trial and error approach. Clearly, there is a need for a more systematic approach based on data analysis. Surprisingly, there is not much literature on how web users consume videos [71]. Locating educational videos is a time-consuming process plus in case of school going students, there is a lack of expertise to evaluate content [78]. This leads to examining metadata, parameters or attributes of videos that may act as a proxy to good content.

The discussion is confined to videos on YouTube. The reasons for choosing YouTube as the target for discussion are namely; YouTube along with being the number one video sharing site is synonymous with online videos [72]. A number of school going students during the course

[18] https://www.khanacademy.org/

of this study were asked if they do use online videos and on which sites they watch them. Without a single exception, YouTube was synonymous with online videos. YouTube is so prominently associated with video sharing that students were not even aware of other sites like Vimeo, Dailymotion[19]. Having postulated the problem, there is a need to scope out video data attributes to be processed for making video recommendations to the students. YouTube provides an API to extract useful metadata from videos like number of views, number of likes, number of dislikes, a brief summary of the video, video transcript in a good number of cases, and user comments when available [78].

Taking into cognizance the aforementioned video attributes the feasibility of making video recommendation for educational purposes are examined. How video attributes cited above can be of assistance towards recommending videos for learning are explored. Most of the video attributes are factual and can be quantified. Consequently, their evaluation is relatively straightforward. A more critical aspect is the evaluation of user comments for understanding user preferences. Evaluation of user opinions being a subjective endeavor requires a more substantial discussion. In the subsequent section, a discussion on mining user opinions is examined.

4.1 Attributes of High-Quality Videos

Despite the best efforts to locate papers that addressed approaches for locating high-quality educational videos for K-12 education no headway was made. Nonetheless, there were a few high-quality papers evaluating the quality of videos for medical student education and for patient information. As the requirements for ensuring delivery of medical information on videos are quite high, these parameters could be adapted to identify sources of high-quality content for K-12 education. Simply stated the fundamental objective is to obtain those aspects (metadata attributes) associated with videos that facilitate the highest quality learning experience for a user with respect to their learning goals.

[19] https://www.dailymotion.com/

Table 4.1: Video quality attributes

Sno.	Video Quality Attribute
1	Trustworthiness
2	Popularity
3	Expert opinions
4	Video length
5	User Ratings
6	Description of the video
7	Aesthetics of the video
8	Sentiment of user comments
9	Availability of captioning
10	Specifies the target audience
11	Relevant to curriculum requirements
12	Social media reference of the video
13	Number of subscribers
14	Content quality of the video
15	Quality of advertisements

As the very nature of quality is multifaceted, contextual and domain dependent its characterization or quantification is difficult. Another aspect of quality that makes it a difficult to define concept is that the characterization of quality can differ based on the persons evaluating it. Thereby instead trying to develop on an agreeable definition of what constitutes quality of a video resource, an attempt is made to characterize the quality of a video inspired by approaches used in the medical domain. A few attributes were adapted from [101] and the rest were developed (table 4.1). The following paragraphs attempt to define each quality attribute as applicable for evaluating the quality of a video.

a) Trustworthiness

The democratic nature of the web permits anyone to upload content. The proliferation of content leads to one major issue i.e. separating the credible from the rest. As in the case of web pages, content published by a reputed organization like Harvard, ISRO, NASA, Yale or an IIT is

far more likely to be credible and authentic than a video by an unknown entity. Reputed authors no longer associated with any formal organization can also be sources of high-quality credible information. Credibility may be viewed as the credentials of the author or the organization. By ensuring the student gets information from authentic sources they are assured on the authenticity and accuracy of content.

b) Popularity

Good quality videos invariably attract eyeballs. This flow of traffic can spread by word-of-mouth or by recommendations from online sources. The increasing popularity of an educational video can be sustained only it is able to effectively meet the expectation of the learners. On social media sites, a higher number of views acts as a proxy for the popularity of the object. One possible inference that can be drawn is that it meets the objectives of the target audience. It is one of the most important metrics and can provide a gateway for further exploration of other quality attributes. Commencing with popular videos on the subject generally leads to locating satisfactory content for learning.

c) Expert opinions

If the video is developed by a domain expert (for example Tyler Dewitt Chemistry) or has the views of a domain expert or the domain expert shares feedback in the form of user comments making a decision on video suitability shall be on much firmer grounds. Expert inputs to correlate positively or negatively the video quality for making video recommendations are taken into consideration.

d) Video length

Preliminary discussions with students and available literature references demonstrate that videos need to be of the appropriate duration and generally must not exceed twenty minutes. Examination of effective learning videos demonstrates that short duration videos are more readily accepted by learners. Longer duration videos irrespective of other merits do not seem to find favor with the learners. One possible assumption is that long duration video leads to boredom and disassociation by a student.

e) User Quantitative Ratings

Videos that are of great value or on controversial topics seem to attract a lot of user opinion. View count, user ratings (likes. dislikes) and number comments provide a baseline indication of the utility of the video for further exploration about its suitability.

f) Description of the Video

Description of videos can act as valuable metadata to know about the video contents, target audience and assist users in shortlisting videos of right type quickly. To determine the suitability of a video examining the description is often faster than viewing the entire video.

g) Aesthetics of the Video

Quite substantial numbers of videos for educational purposes are found to be simply recordings of classroom or tutorial classes. India particularly has a preponderance of tutorials in schooling and for entrance exams to higher education. Numerous studies have found that video recordings are ineffective tools for learning as indicated by high dropout rates in MOOC's. By actually viewing the video, parameters pertaining to audio, presentation, sound quality, and other critical parameters may be evaluated.

h) Sentiment polarity of user comments

The popularity of community opinions on sites like Amazon, eBay over a number of years has proved their relevance and utility in making informed decisions. Sentiment analysis of user feedback may act as a powerful indicator or user attitudes towards the video and can be utilized in making video recommendations. An advantage of sentiment analysis is it provides group opinion towards the videos but may miss fine-grained information that can at times be critical in providing valuable information.

i) Availability of captioning

Development of closed captioning has multiple advantages. Firstly, with a number of high-quality videos being developed for an international audience, the availability of captioning ensures accent, and language does not act as a barrier to learning. Also, the development of captioning indicates an element of planning in video delivery due to the requirement of having to

develop a script with a learning goal in mind. Poor and hastily composed videos would most likely suffer from the lack of captioning.

j) Specifies the target audience

The description of the video along with user comments can provide valuable insights into the target audience and learning objectives in mind. Ensuring that the video content is applicable to the right school grade is a valuable asset in determining its utility. Information that is too basic or too advanced shall simply fail to meet the learning objectives despite the fact that the video may possess other compelling attributes.

k) Relevant to curriculum requirements

As the goal is to supplement and complement learning at school, it is necessary that the learning material identified is closely aligned with the curriculum design. Failure to meet curriculum objectives shall lead to information overload and failure to meet the learning objectives.

l) Social media references to the video

With the growing role of social media in all spheres of life, video recommendations by them cannot be ignored and form a valuable source for directing users towards videos. Information on social media sites like Quora can be a source for video recommendations. Unfortunately harvesting them for recommendations is an endeavor in itself requiring a separate effort.

m) Number of Subscribers

Popular educational channels on YouTube have numerous subscribers to their videos. As in the view count attribute, subscriber numbers can act as a proxy to the quality and popularity of the content provided by the channels.

n) Content quality of the video

Accuracy, relevance and good content are the most relevant in relation to all other attributes. Lamentably this metric can only be evaluated by domain experts after going through

the video a time-consuming activity. All of the above attributes are going to be examined in relation to their role in indicating the quality of the content.

o) Quality of advertisements

It can be safely assumed that reputed advertisers shall use high quality, reputed video sources to reach their target audience. Choice of selecting videos is both a function of the traffic and the associated demographics of the video. Examination of the reputation of the advertisers shall provide a window of opportunity to evaluate the video quality.

4.2 Educational Video Selection - Data Collection and Analysis

Topics from grade nine NCERT curriculums of Algebra, English Grammar, Chemistry, and Physics formed the sample to develop queries for video search results. Queries from selected topics were developed by the domain experts and they were executed against YouTube. There were fifteen attributes indicative of the quality of content mentioned in the prior section. As it is clearly impractical to examine all the attributes with the required thoroughness, only the following nine attributes with respect to quality of video content were examined (post a quick pilot review).

a) Trustworthiness
b) Popularity
c) Length of the video
d) User Ratings
e) Description of the video
f) Sentiment of user comments
g) Availability of captioning
h) Relevance to curriculum
i) Number of Subscribers

Approximately two hundred odd videos were examined. The user comments for each of the videos are extracted via a program and then processed using a machine learning algorithm for polarity detection. Similar to the approach used in evaluating the quality attributes of a webpage,

the quality attributes of videos shall be evaluated by a two-member team working in tandem and recording their opinions on the individual quality parameters. The evaluators examined the top ten ranked videos after each search query in YouTube on the parameters shortlisted. Each of the quality attributes shall be rated with respect to its relation to the content of the video. Table 4.2 was used for recording the attributes for each video.

Table 4.2: Template for recording quality attributes of each video

Sno.	Attribute	Remarks
1	Query	"ionic formulas"
2	URL	https://www.youtube.com/watch?v=URc75hoKGLY
3	Trustworthiness	High
4	Popularity	1.59 M
5	Length of the video	11:43 minutes
6	Availability of video description	Yes
7	Availability of captioning	Yes
8	Relevant to curriculum	Yes
9	Number of Subscribers	530,000
10	Content Quality	(E)xcellent
11	User Ratings (likes, dislikes, and number of comments)	17000/306/1705

Data Analysis

Two evaluators with knowledge of the school curriculum and learning requirements of students were assigned the task of examining different parameters and tabulating them. With the exception of content quality and the relevance of the video to the curriculum, the rest of the parameters were objective information and required no discussion. For these two parameters content quality and curriculum fit, the evaluators made decisions based on the consensus of opinion. Observations of the evaluators are summarized in table 4.3.

Table 4.3: Summary of expert opinion on educational videos

Video Quality Attribute	Findings
Trustworthiness	With few exceptions, most of the videos with good content belonged to channels owned by a reputed organization or people possessing domain expertise and reputation in the subject matter. For example, some of the outstanding videos on Chemistry were by Tyler Dewitt a recognized authority on Chemistry.
Popularity	If the search query was able to generate video relevant to the learning requirements, view count was the most important marker of content quality. Invariably higher view count is a proxy for good content. For example, good lessons on English Grammar were usually the top three having the highest view counts. At times solely relying on view counts as the single quality parameter is not effective as search brings up parodies and other viral videos not relevant to the query in the topmost rankings.
Length of the video	As previous studies on the length of videos have indicated, videos not exceeding fifteen minutes were generally well received as opposed to video exceeding the time limit. In fact, it was rare to find a video that was both good and had a duration longer than fifteen minutes. This finding is in consonance with other studies. Content being presented within fifteen minutes had better engagement with the students.
User Ratings (likes, dislikes, and number of comments)	The number of likes and comments possess an almost linear relationship with respect to view count. Although, the number of dislikes did not follow any pattern but was a useful metric in indicating the content quality. If the number of dislikes exceeded the likes more than likely the content of the video was unsatisfactory.
Description of the video	Ensuring proper video description by the developers of the video

	indicated attention to the development of a well-organized video. Some of the descriptions were brief and others were well detailed indicating the objectives and expectations of the video lesson. It was, however, difficult to draw any positive correlation between quality of content and availability of proper video description.
Availability of captioning	Majority of the educational videos possess closed captioning to aid learners in comprehending the content. While it was difficult to draw inferences with respect to quality of content, their value cannot be discounted. Captioning ensures greater comprehension by surmounting any challenges a learner may encounter due to accent.
Curriculum Fit	Since videos are invariably developed for a general audience in the domain, it was difficult to locate videos that adhered to the curriculum. Having said that good quality videos supplemented and complemented the classroom learning experience effectively.
Number of Subscribers	Channels providing a better quality of content possessed more subscribers than similar channels in the domain. A higher number of subscribers was indicative of channel popularity but was difficult to correlate with content quality of individual videos. Also, all the videos in a channel were not of the same quality. Channels may be delivering content in the same domain but their treatment and coverage of content were not necessarily overlapping.

Notwithstanding the fact that only about two hundred odd videos were examined by the evaluators for determining the effect of the parameters on video content quality, this need not diminish the findings as the videos checked spanned a spectrum of educational requirements. A few observations need emphasis. Firstly, that search keywords are critical to locating video content relevant to learning requirements. Searching is better off being done by teachers or with their assistance. Secondly, videos developed by Indian authors though having high popularity