Positive and Negative Qualities in Computer Science YouTube Tutorials: A Review of Current Research

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ABSTRACT / INTRODUCTION

The number of computer science graduates has nearly doubled within the past 10 years. With an influx of students entering the workforce, online websites such as YouTube and Stack Overflow have seen a massive uptick in users when these programmers experience issues. YouTube has a unique position in education; much research has already been conducted regarding effective usage of YouTube in and out of the classroom. Highlighted alongside efficient usage of YouTube are qualities which may hinder learning. Since YouTube tutorials are widely used in the Computer Science profession, poorly constructed content can have a negative impact on the projects being produced by the user, and can even promote bad habits. This project aims to illuminate positive and negative qualities for Computer Science YouTube tutorials to avoid that outcome. To determine these qualities, I will draw connections in research from multiple fields (Fig. 1)

METHODS

- Research Fields
  - Human Learning Processes
  - Multimedia Learning
  - Computer Science Education
- Websites Queried
  - Google Scholar
  - PubMed
  - SagePub
- Search Terms, Phrases, and appendages
  - "Multimedia Leraning"
  - "Computer Science Education
  - "Learning Processes"
  - "Analysis of ..."
  - "Efficiency of ..."
- Miscellaneous Reference Gathering
  - Paper's reference page
  - Backward Citation Search
  - Forward Citation Search
  - Recommended Articles
    - PubMed and SagePub specific
  - Filtering for results from 2019 and later
- Minimum Read-Through
  - Introduction
  - Results
  - Discussion

IMPORTANT QUALITIES

1. **Segmenting Principle**
   Learning is enhanced when multimedia lessons are presented in user-paced segments as opposed to a continuous unit

2. **Personalization Principle**
   Learning is enhanced when the words are spoken in a conversational style rather than formal

3. **Project-Based Learning**
   Multiple studies support learning through hands-on activity (like through educational games or projects). YouTube videos can uniquely satisfy this by providing examples and detailing their thought process in the solution

4. **Balancing Theory**
   Computer Science has a side of complex theory which is uniquely vital for students to understand. A good balance between theory and application has been proven to enhance learning.

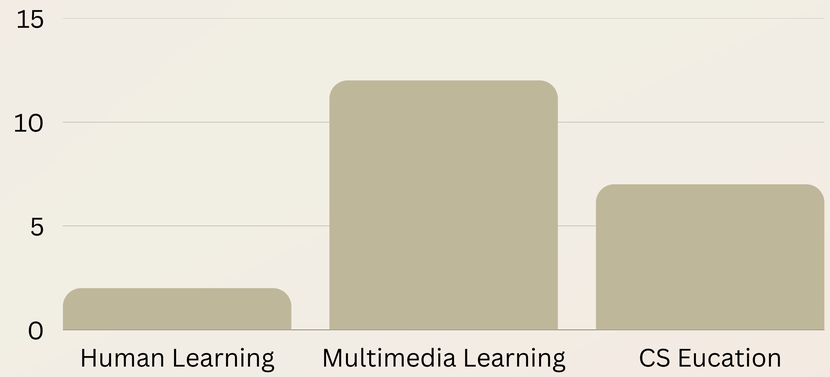
5. **Video Length**
   Computer Science tutorials are often long, making it difficult to sift through and find relevant segments.

6. **Pre-Training Principle**
   Learning is enhanced when the learner has prior knowledge on the topic of the information being learned. This essentially means that videos that start with a brief overview / basic introduction are more effective for the learning process

7. **Coherence Principle**
   Learning is enhanced when extraneous information is cut out. Cut out fluff, include only what the learner needs.

8. **Generative Activity Principle**
   Learning is enhanced when learners are guided in carrying out generative learning activities during learning

Fig 1. Amount of Research Found Per Category



ADDITIONAL RESULTS / DISCUSSION

- These results exist under the (supported) assumption that multimedia learning is more efficient than learning through a single medium (sound, text, etc.).
- Topics pertaining to memory allocation (which requires an understanding of hardware and software interactions) consistently rank among the hardest topics for CS students to understand.
- Invoking structural learning (learning complex information through visualization of systems and their interactions) isn't an indicator of quality, but can improve learning when utilized correctly.

REFERENCES

- Mayer, R. E. (2021). Multimedia learning (Third edition). Cambridge University Press.
- Tan, P.-H., Ting, C.-Y., & Ling, S.-W. (2009). Learning Difficulties in Programming Courses: Undergraduates' Perspective and Perception. 2009 International Conference on Computer Technology and Development, 1, 42–46.
- MacLeod, L., Storey, M.-A., & Bergen, A. (2015). Code, Camera, Action: How Software Developers Document and Share Program Knowledge Using YouTube. 2015 IEEE 23rd International Conference on Program Comprehension, 104–114.
- Milne, I., & Rowe, G. (2002). Difficulties in Learning and Teaching Programming—Views of Students and Tutors. Education and Information Technologies, 7(1), 55–66.
- Lange, P. G. (2018). Informal Learning on YouTube. In The International Encyclopedia of Media Literacy (pp. 1–11). John Wiley & Sons, Ltd.
- Lopez-Fernandez, D., Tovar, E., Alarcon, P. P., & Ortega, F. (2019). Motivation of Computer Science Engineering Students: Analysis and Recommendations. 2019 IEEE Frontiers in Education Conference (FIE), 1–8.
- Minnes, M., Alvarado, C., Geislinger, M., & Fang, J. (2019). Podcast Highlights: Targeted Educational Videos From Repurposed Lecture-capture Footage. Proceedings of the 50th ACM Technical Symposium on Computer Science
- Gruffat, C. (2015). Tutorials on YouTube. A Study from the Perspective of Digital Humanities.
- Piteira, M., & Costa, C. (2013). Learning computer programming: Study of difficulties in learning programming. Proceedings of the 2013 International Conference on Information Systems and Design of Communication, 75–80.