RESEARCH TALK

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Research Directions (if any)

- Something Interesting
  - Else let industry take care of it
- Something Useful
- Something Fundable
  - Graduate students expect stipends to do research!
- Something I know something about
  - *Or nobody knows anything about*

Research Areas

- Parallel and Distributed Systems

  Volpex: Reliable execution when failure/errors are routine (MTBF in minutes) [*with Dr. Gabriel*]

  - Very large scale systems (1000s of nodes)
  - Volunteer computing – 100s of ordinary PCs distributed around the world solving scientific problems

- Educational Technologies

  - *Indexed Captioned Searchable (ICS) Videos*

Background

- Video medium is ubiquitous and growing for coursework
  - MOOCS, iTunes U, MIT Courseware, UH…
  - Supplement or replace lectures
- Key shortcoming of video format is the inability to quickly access content of interest
  - Loud and clear in surveys and interviews
  - Students wants answers to questions for review, not watch an hour long video

ICS Videos in a Nutshell

- **Custom video player that allows quick access to video content of interest**
  - **Indexing:** Video divided into logical segments with clickable index points
  - **Search:** Keyword search in video
  - **Captioning:** Scrolling captions for audio.

ICS Videos in a Nutshell

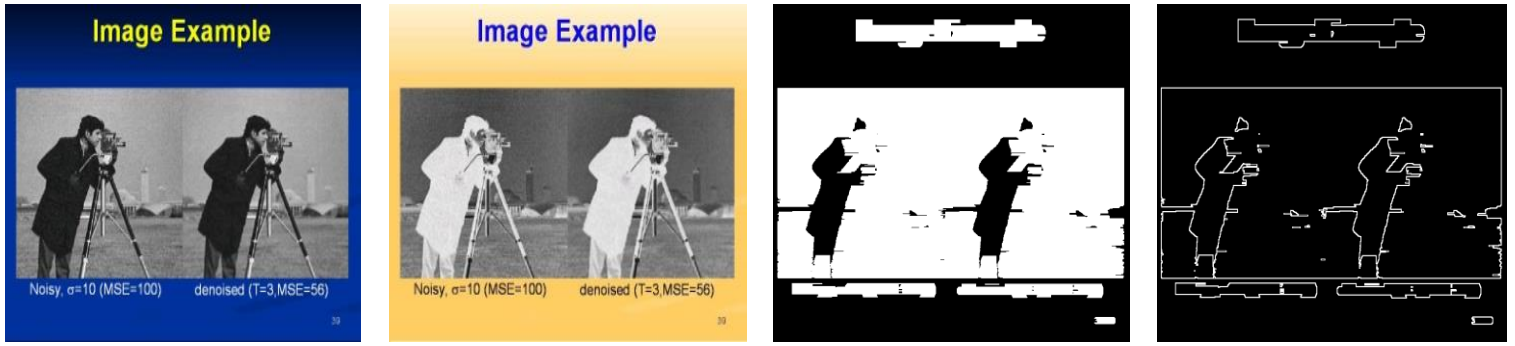
Text Search

User types a k*eyword* -- all segments of the video that match are presented

Challenges:

- Recognize text on video frame: OCR enhanced with custom image transformations for text recognition
- Semantic search ?

Original Image | Inversion | Dilation | Edge Detection

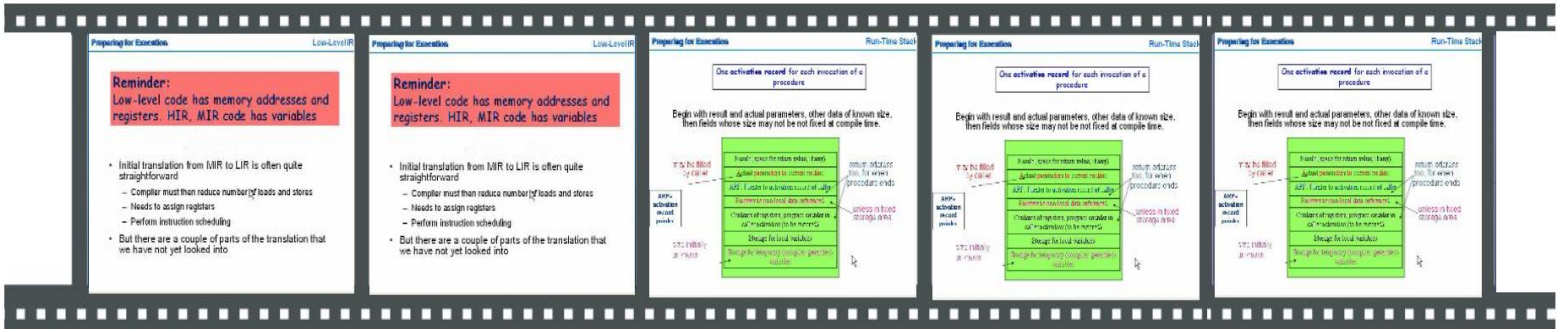


Automatic Indexing

The video is presented as a series of clickable segments, each with a visual index frame

Challenges:

- Identify *Topic Changes*, beyond scene changes. Based on recognition and analysis of text patterns
- Combined with semantic and audio input ?



Text Captions

Video player supports captions:

- Semi-automatic caption generation employing speech recognition (YouTube)
- ICS Caption Editor for correcting captions manually
  - “Crowdsourcing” option

Text Captions

Welcome rucha! Logout

ICS Caption Editor

Help | Watch Video

Legend

- Section currently being edited
- Caption is Complete
- Caption Needs a Review

PlaySpeed: Real

0 Completed!, 0 Requested for Review, 14 remaining.

Section No.	Start Time (mm:ss)	Caption Text	Save my Changes	Status	Review Count
Edit Section 1	0:05	Lets talk about floating point today.We have seen the ways of representing numbers in binary so far	Save	Mark as Complete	
	0:13	the largest we've gotten with the unsigned integers we preferred edited by Rucha	Save	Mark as Complete	
	0:18	two to the n minus one ending number in bits you have represent and with sign integer the two complement we have negative two to the n minus one	Save	Mark as Complete	
	0:26	two to the n minus one minus one because one less positive number than the negative number. So the question you might	Save	Mark as Complete	
	0:37	represents a very large numbers or even decimal number, rational number like pi or the natural number e. The way we do this	Save	Mark as Complete	
Edit Section 2	0:50	to go back and look at scientific notation base tenth	Save	Mark as Complete	
	0:56	things to note the number before the decimal point were call the mentissa	Save	Mark as Complete	
	1:04	the radix or the base that you're in so we're are talking about base 2 that would be 2 and an exponent number	Save	Mark as Complete	
	1:15	multiple ways to represent this number, of course, like we have point 1 and ten to the negative ten. However, to make sense you want to have stuffs in normalize form	Save	Mark as Complete	
	1:27	based ten that just means you have one number before the decimal point and that is also true with binary	Save		

Diverse Research Challenges

- Enhancing text from video frames by enhancing OCR accurately [Image processing]
- Identifying Index Points [Text processing, Machine Learning]
- User Interface Design
- Learning Methodologies [Education, Psychology]
  - Measurement of Enhancement of Learning
  - Inverted Classrooms

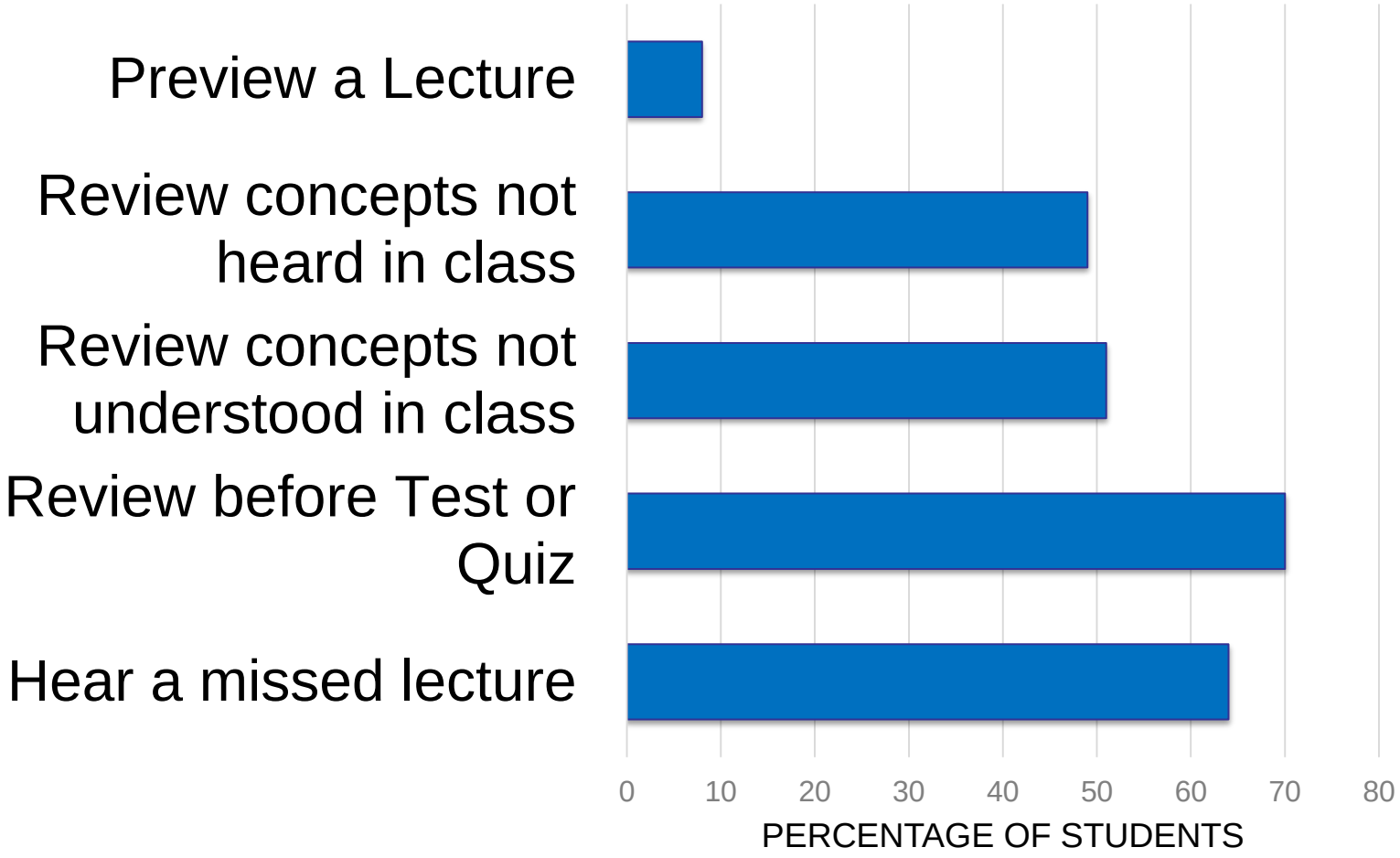
Deployment and Experience

- Widely used at University of Houston in the Departments of Biology, Chemistry, Computer Science, Geology, Mathematics

Estimate ~10,000 student users in past 3 years in ~70 courses in 6 STEM fields at UH

~3000 participated in surveys

Reasons For Using Videos

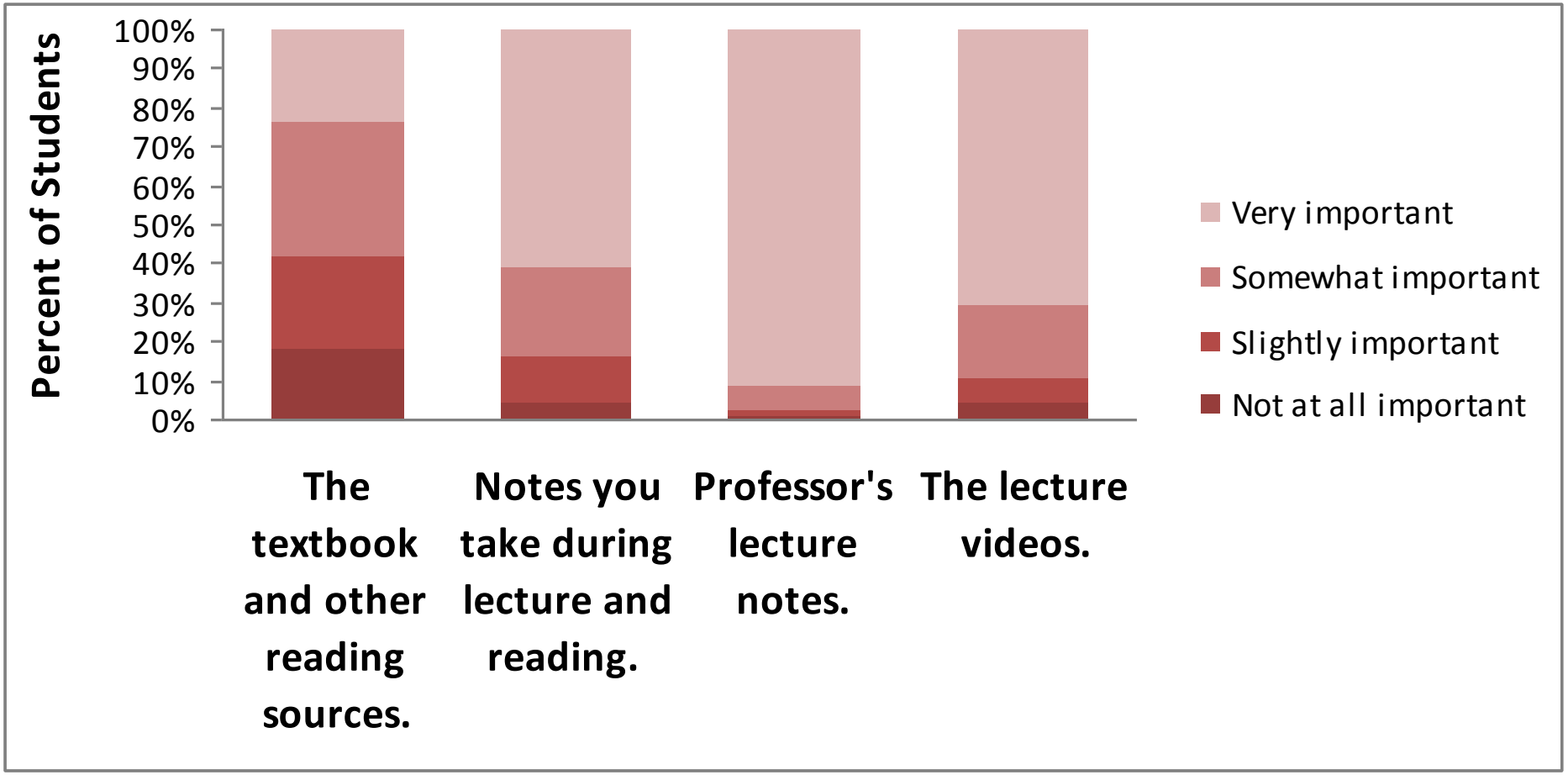


Student Evaluation of Videos

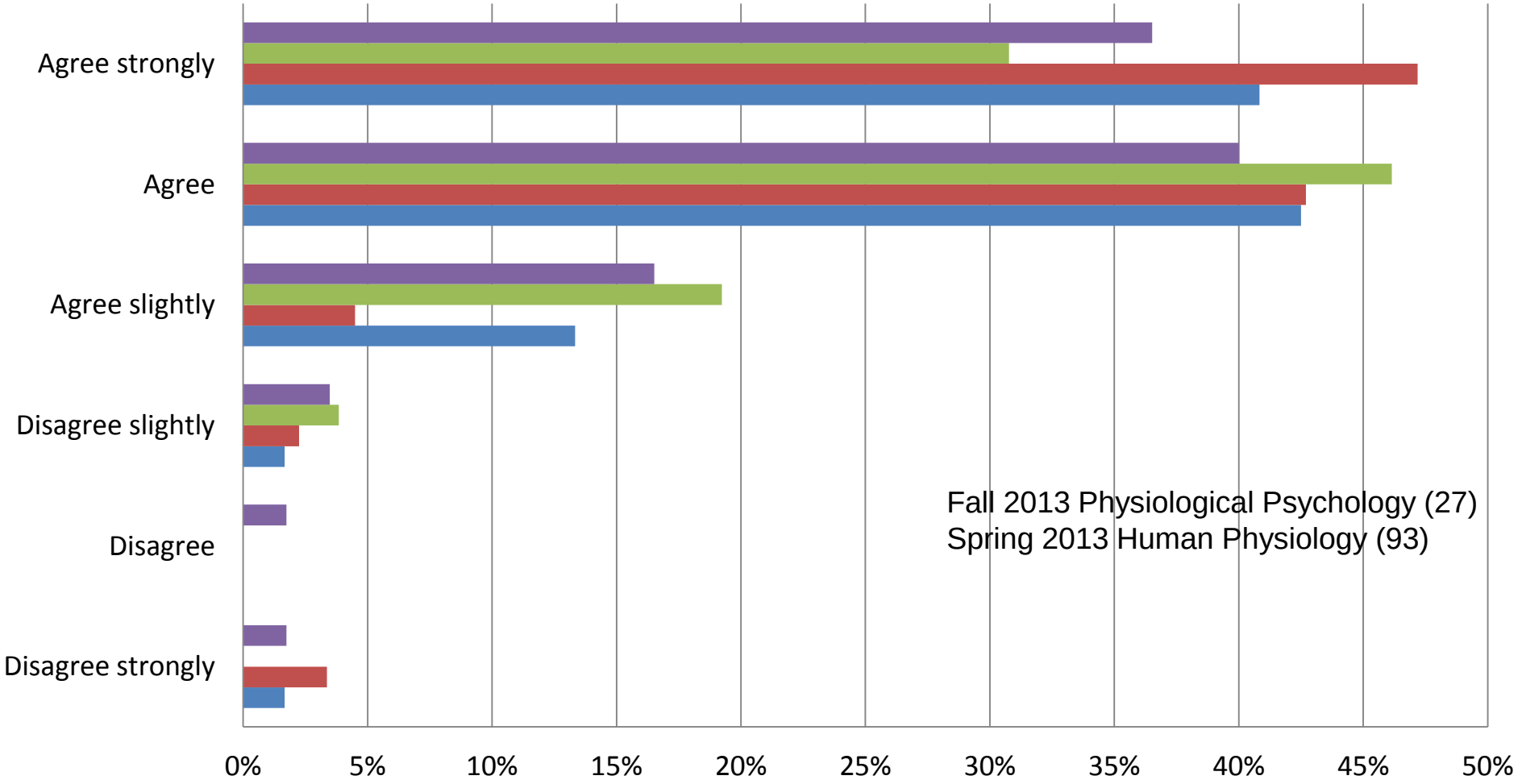
Evaluation Item	Mean
Lecture videos help clarify material that was not clear in class.	**5.45**
Lecture videos are useful for reviewing.	**5.63**
Having access to video lectures for this class is important to me.	**5.61**
The lecture videos helped me to study for quizzes or tests.	**5.51**

Scale: 1 = Disagree Strongly , 6 = Agree Strongly

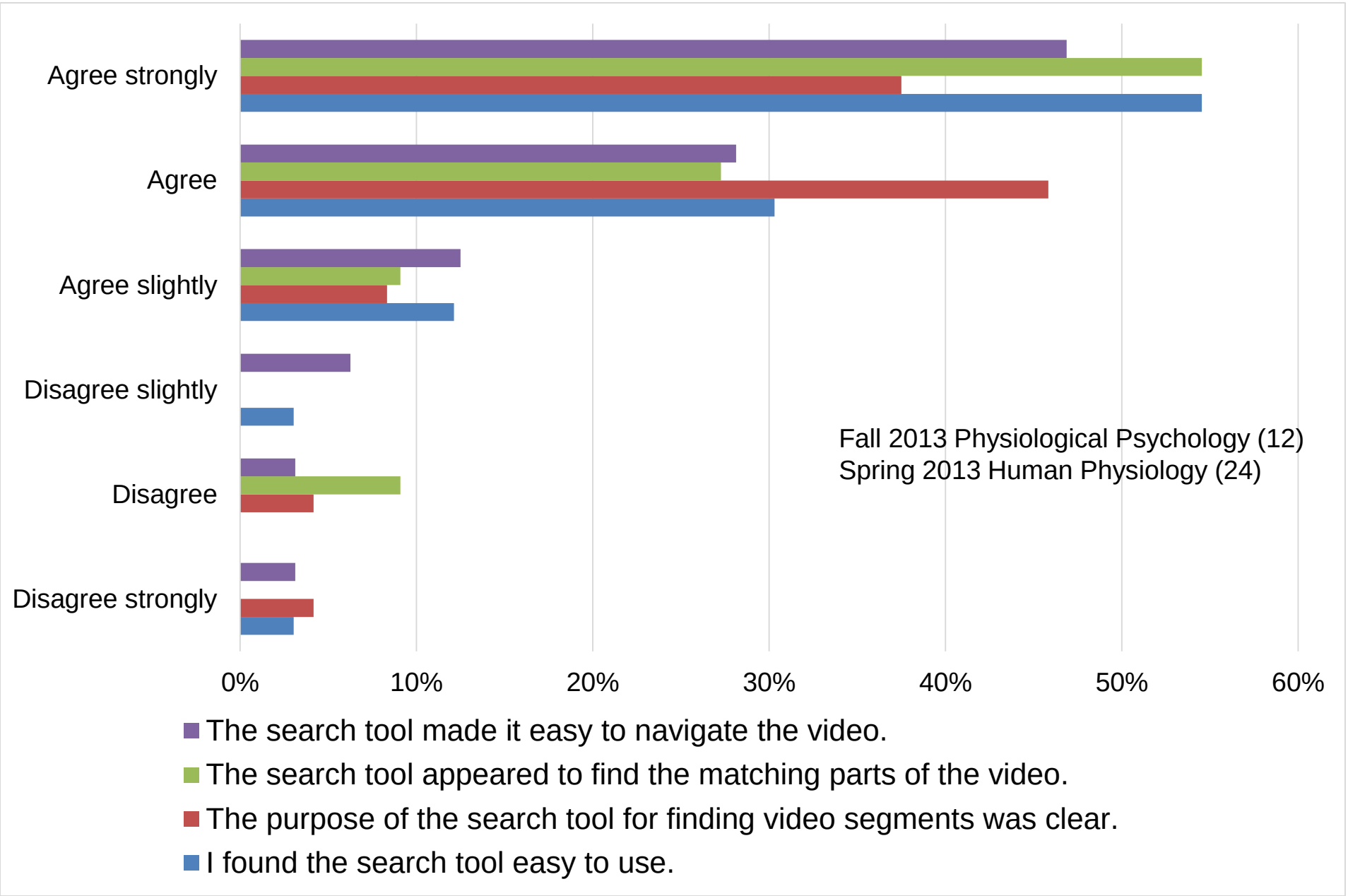
Videos as a Resource



Student response: Indexing



Student response: Search



Project Team

CS Faculty: Zhigang Deng, Olin Johnson, Shishir Shah, **J. Subhlok**

Students: Tayfun Tuna, Varun Varghese, Rucha Borgaonkar, Mahima Joshi
X-Students: J. Li, C. Yun, G. Bhatt, T. Tuna. A. Verma, R. Kushalnagar

NSMIT Staff: S. Baez-Franseschi, Pradeep Krishnan, Andrea Arias

Assessment: Lecia Barker (UT Austin), Yumei Liu, Erin Hodges (UH)

Deployment, usage and assessment

UH Computer Science, UH Geosciences, *UH Biology and Biochemistry*
UH Downtown ***(Richard Alo),*** *Texas School for the Deaf* ***(David Coco)***

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jaspal@uh.edu

Many small and large projects for BS, MS or PhD students!

Contact Info

- ICS Videos System

  www.icsvideos.uh.edu
- Username: student
- Password : icsstudent

- More details/papers about the project

  www.icsvideos.cs.uh.edu

- Contact email:

  icsvideoscontact@gmail.com