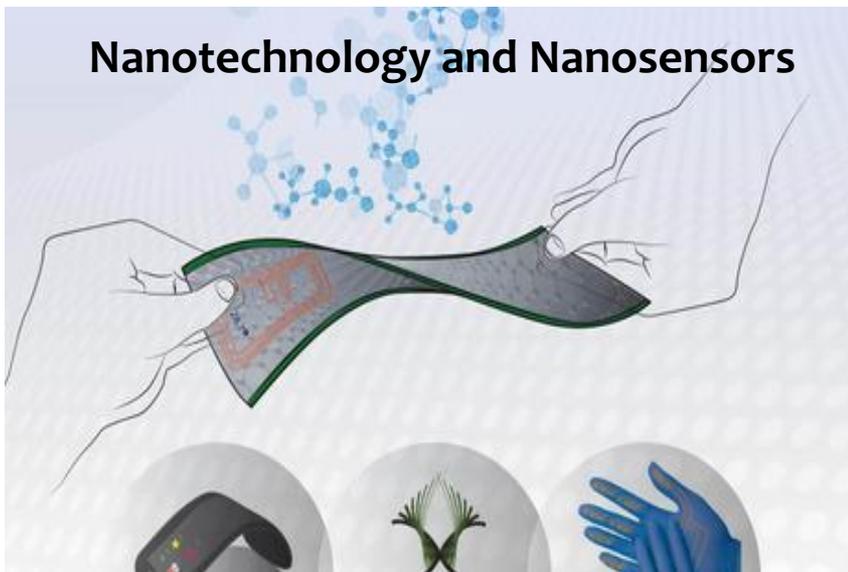


Nanotechnology and Nanosensors



التقانة والمستشعرات النانوية - الجزء الاول



Prof. Hossam
Haick



Asst. Prof.
Miri Barak



Abeer Watted
PhD stud.



Meital Segev
PhD stud.



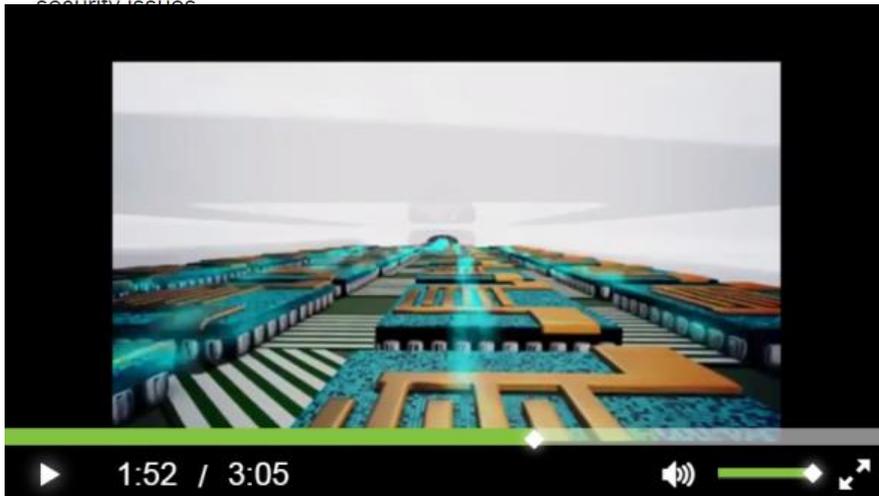
Nisreen Shehada
PhD stud.

Course lecture videos



Nanotechnology and Nanosensors

Learn about novel sensing tools that make use of nanotechnology to screen, detect and monitor various events in personal or professional life. Together, we will lay the groundwork for infinite innovative applications, starting from diagnosis and treatments of diseases, continuing with quality control of goods and environmental aspects, and ending with monitoring security issues.



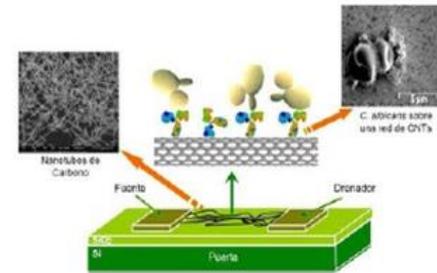
Course assignments

Weekly quizzes: 30% of your overall course grade.

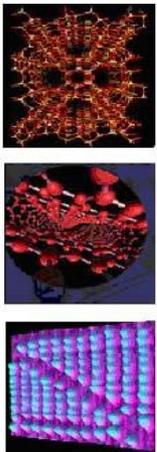
Open questions: 20% of your overall course grade, according to the average of votes, posts, and views.

The sensor in the image is probably:

- A. An optical sensor
- B. An electrochemical sensor
- C. A mass sensitive sensor
- ✓ D. A biological sensors



- If you could have an additional sense, in addition to the five you have, what sense would you wish for?
- Which kind of sensors would you like in your smartphone?



Project-based Learning in Small Groups

Designing a nanosensors to imitate a specific sense, **50%** of overall course grade



Robotic insect based-human odor sensor

Nanosensors for hearing aids

The image block contains several components:

- Four different types of microphones: a vintage-style microphone on a stand, a modern handheld microphone, a small black circular microphone, and a long, thin, cylindrical microphone.
- An anatomical diagram of the human ear with labels: External Ear Canal, Tympanic Membrane (Eardrum), Middle Ear Space, Eustachian Tube, Cochlea (Hearing Canal), Hearing Nerve, Balance Nerve, Vestibular Nerve, and Oval Window.
- Two scanning electron microscope (SEM) images showing the intricate, hair-like structures of the cochlea.
- A schematic diagram of a nanosensor. It shows an acoustic wave input (air pressure wave) in dB being converted to MPa. The sensor consists of a diaphragm (1 μm thick) with acoustic holes, an air gap (2 μm), and a backplate (2 μm). A pressure equalization hole is also shown. The electrical signal output is indicated by an AC symbol.

Mosquito movement sensing



Figure 1 Sensing principle

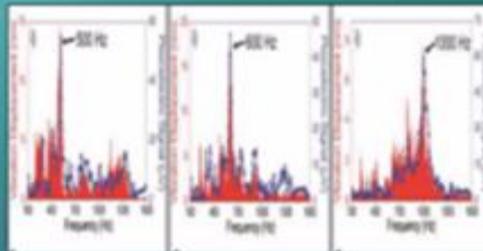
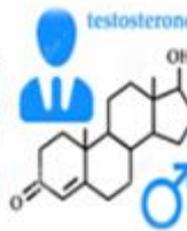
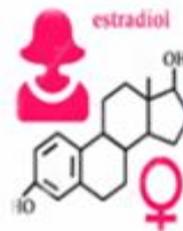


Figure 2 Expected results

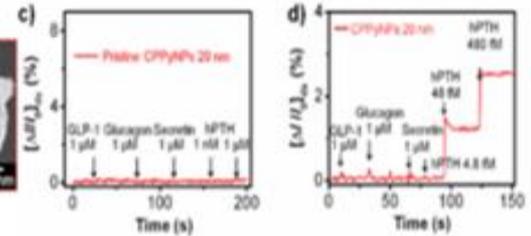
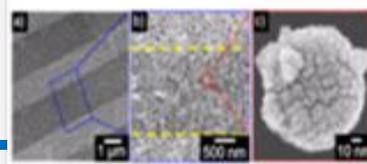
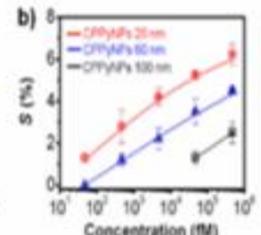
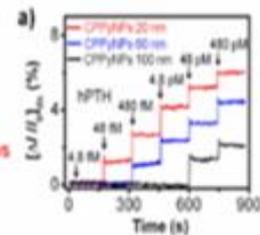
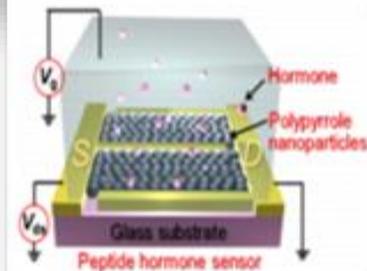
Mosquito winging wings can generate an acoustic wave signal of **500-600Hz**. PZT acoustic sensor is attached to a cylinder whose resonance frequency is around **500-600Hz**.



Figure 3 Fabrication process



- When human beings fall in love, they will release numerous hormones.
- Close-packed arrays of carboxylated polypyrrole nanoparticles (CPPyNPs) and their integration with human parathyroid hormone receptor



Forums

[View your latest activity](#) | [Subscribe for email updates.](#)

Welcome to the course discussion forums. Please read our [new thread](#).

Sub-forum

Who are you?

Tell us a little bit about yourself

Study Groups

Find friends and arrange meet ups!

Lectures

Questions about the lectures

Assignments

Questions and clarifications about the assignments

General Discussion

General discussion about the course, life, and everything under the sun

Course Feedback

Post your opinion about the course and suggest ways for improvement

Signature Track

Ask any questions about the Verified Certificate or Signature Track. For more information, contact your typing authentication, webcam photo submissions, or Signature Track Support Team, or Coursera's Signature Track Support Team.

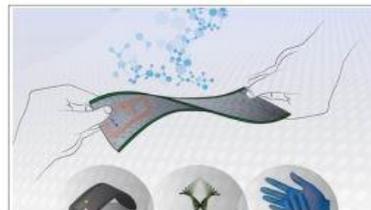


JULY 11, 2014

Statement of Accomplishment

JOHN DOE

HAS SUCCESSFULLY COMPLETED AN NON-CREDIT COURSE OFFERED BY THE TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY:



Nanotechnology and Nanosensors

This course discusses interdisciplinary scientific and engineering knowledge at the nanoscale, including the principles behind nanotechnology and nanomaterials and their vital role in novel sensing properties and applications.

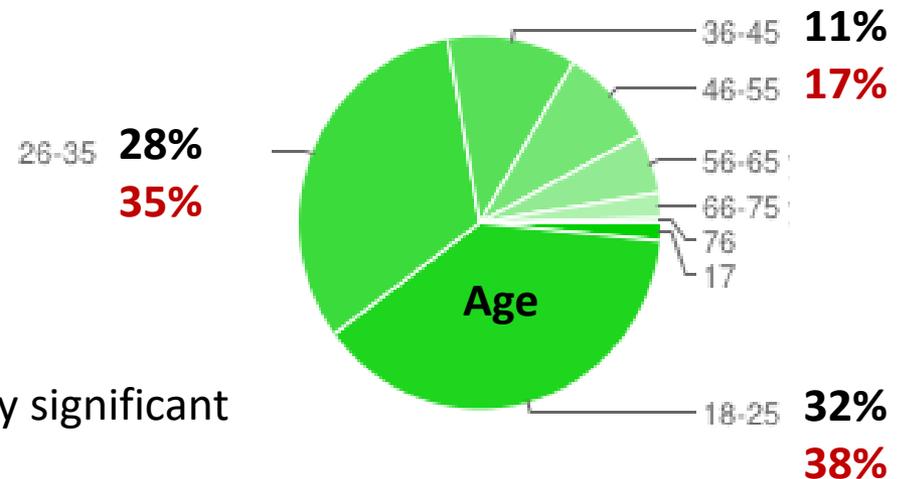
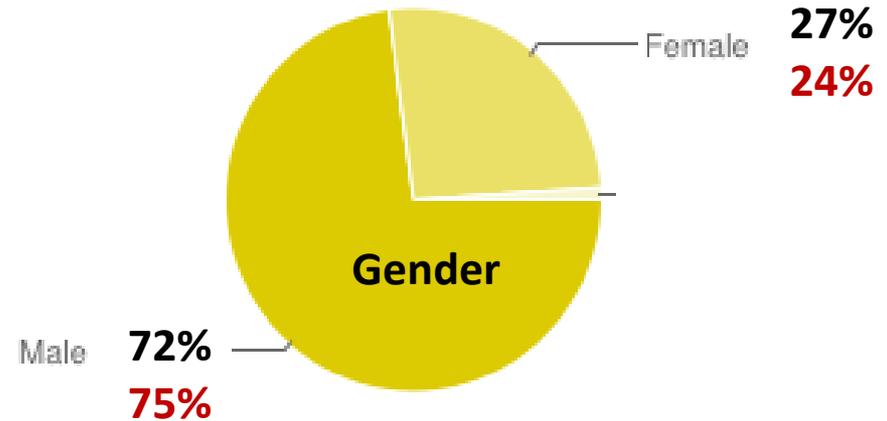
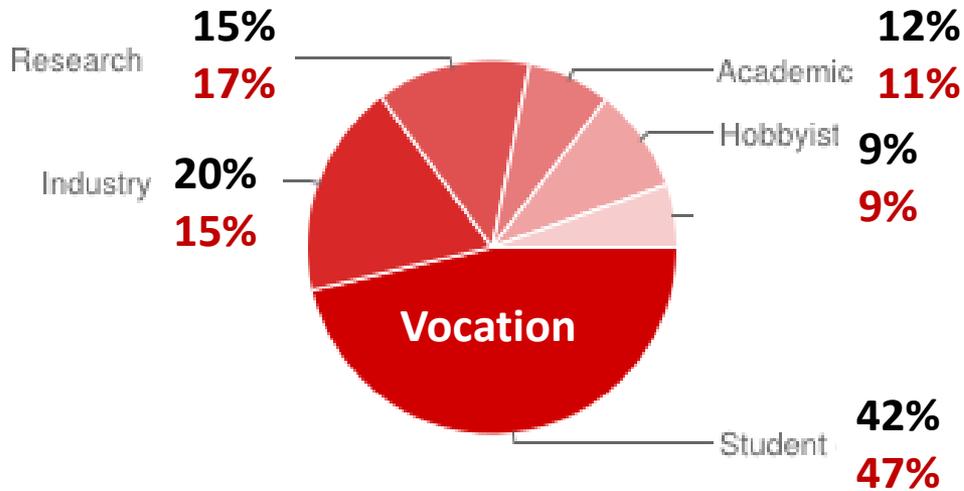
A handwritten signature in black ink, reading "haick".

PROF. HOSSAM HAICK
HEAD OF THE LABORATORY FOR NANOMATERIAL-
BASED DEVICES (LNBD) AND VOLATILE BIOMARKERS
DEPARTMENT OF CHEMICAL ENGINEERING AND
RUSSELL BERRIE NANOTECHNOLOGY INSTITUTE
TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

PLEASE NOTE: THIS STATEMENT DOES NOT AFFIRM THAT THIS STUDENT WAS ENROLLED AS A STUDENT AT THE TECHNION IN ANY WAY. IT DOES NOT CONFER A TECHNION GRADE, IT DOES NOT CONFER TECHNION CREDIT, AND IT DOES NOT VERIFY THE IDENTITY OF THE STUDENT.

MOOC Participants

English (N = 11,210) Arabic (N = 2,195)



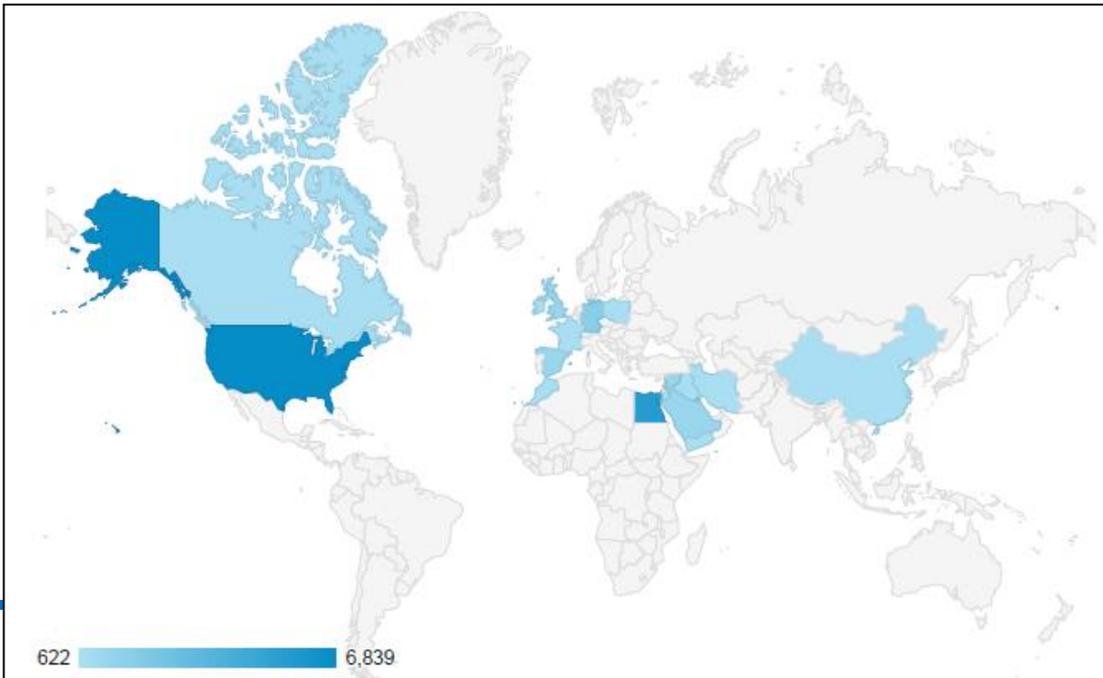
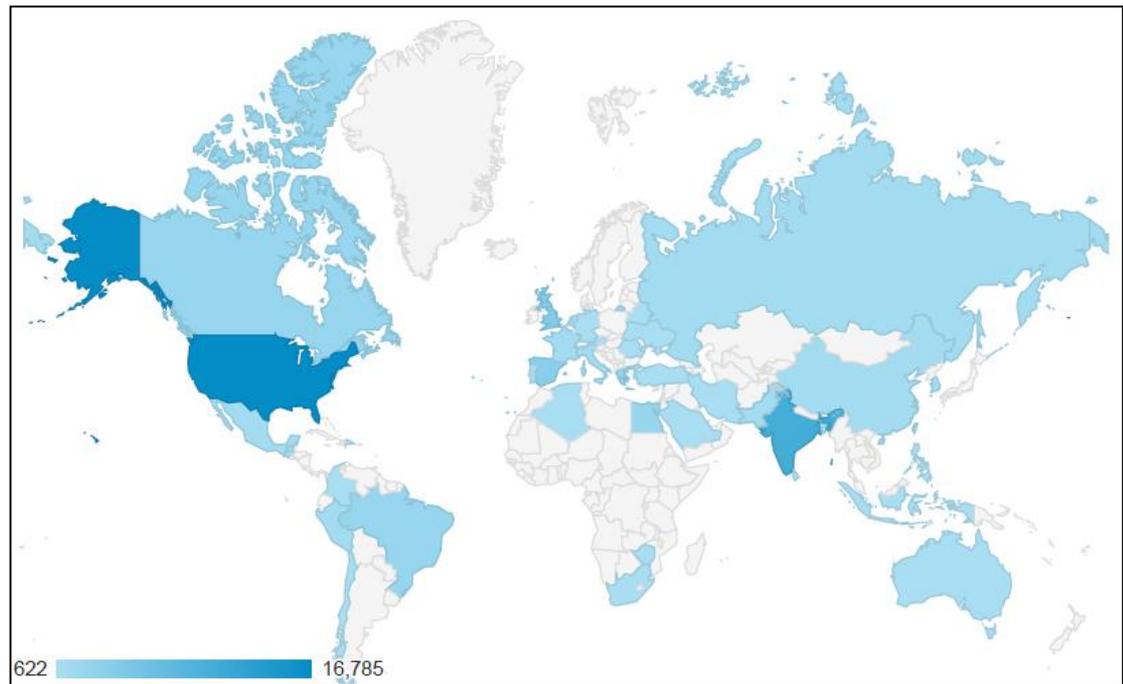
Pearson Chi-Square test indicated no statistically significant differences between the two groups

Nationalities

English course (11,210):

United States, India, United Kingdom, Spain, Brazil, Canada, Egypt, Greece, Taiwan, China

Index of heterogeneity = **0.92**



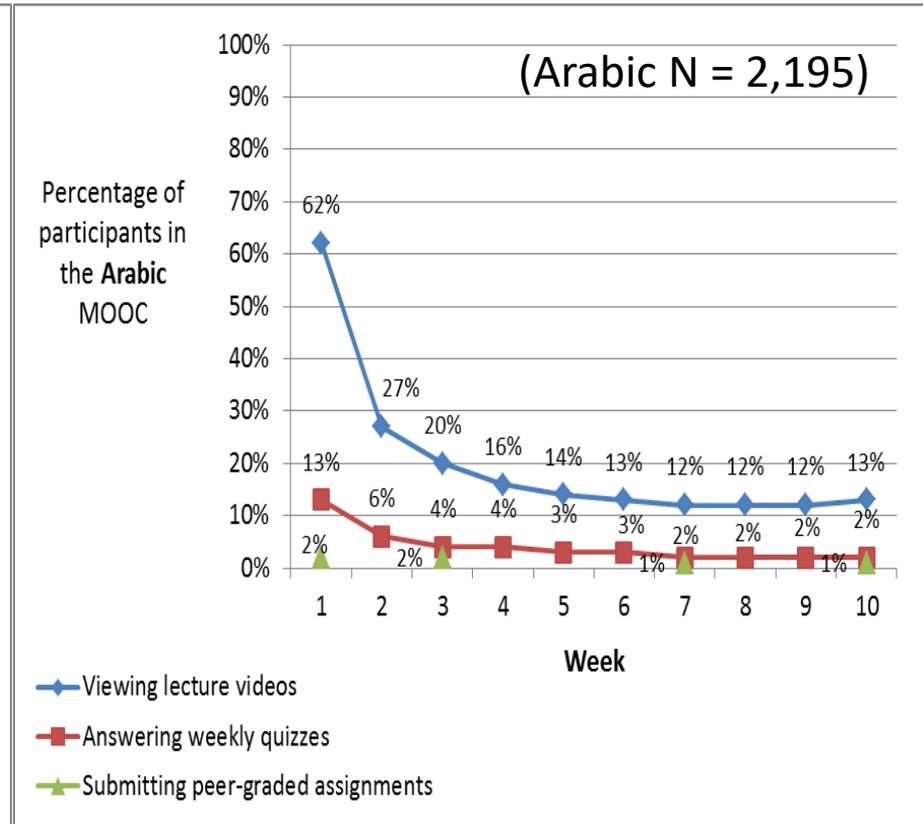
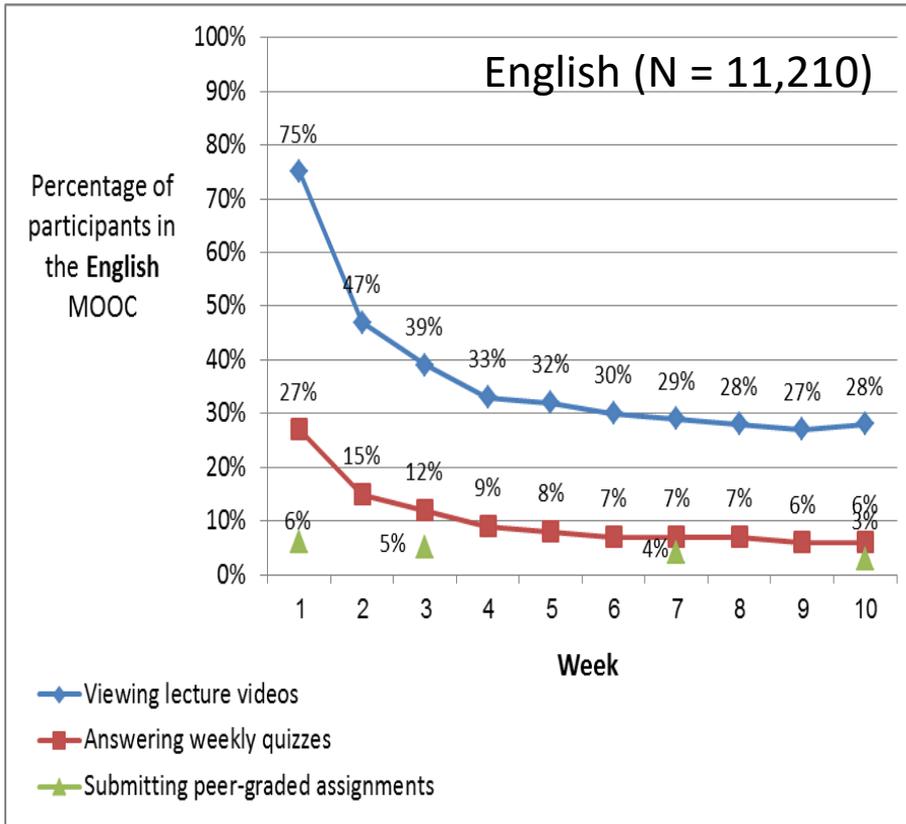
Arabic course (2,195):

United States, Egypt, Israel, Germany, Kuwait, Spain, United Kingdom, Saudi Arabia, Syria, Canada

Index of heterogeneity = **0.74**

Engagement

Participation curves by learning activity per week



Viewing lectures: $r = .99$ $p < .001$; $t = 25.67$ $p < .001$

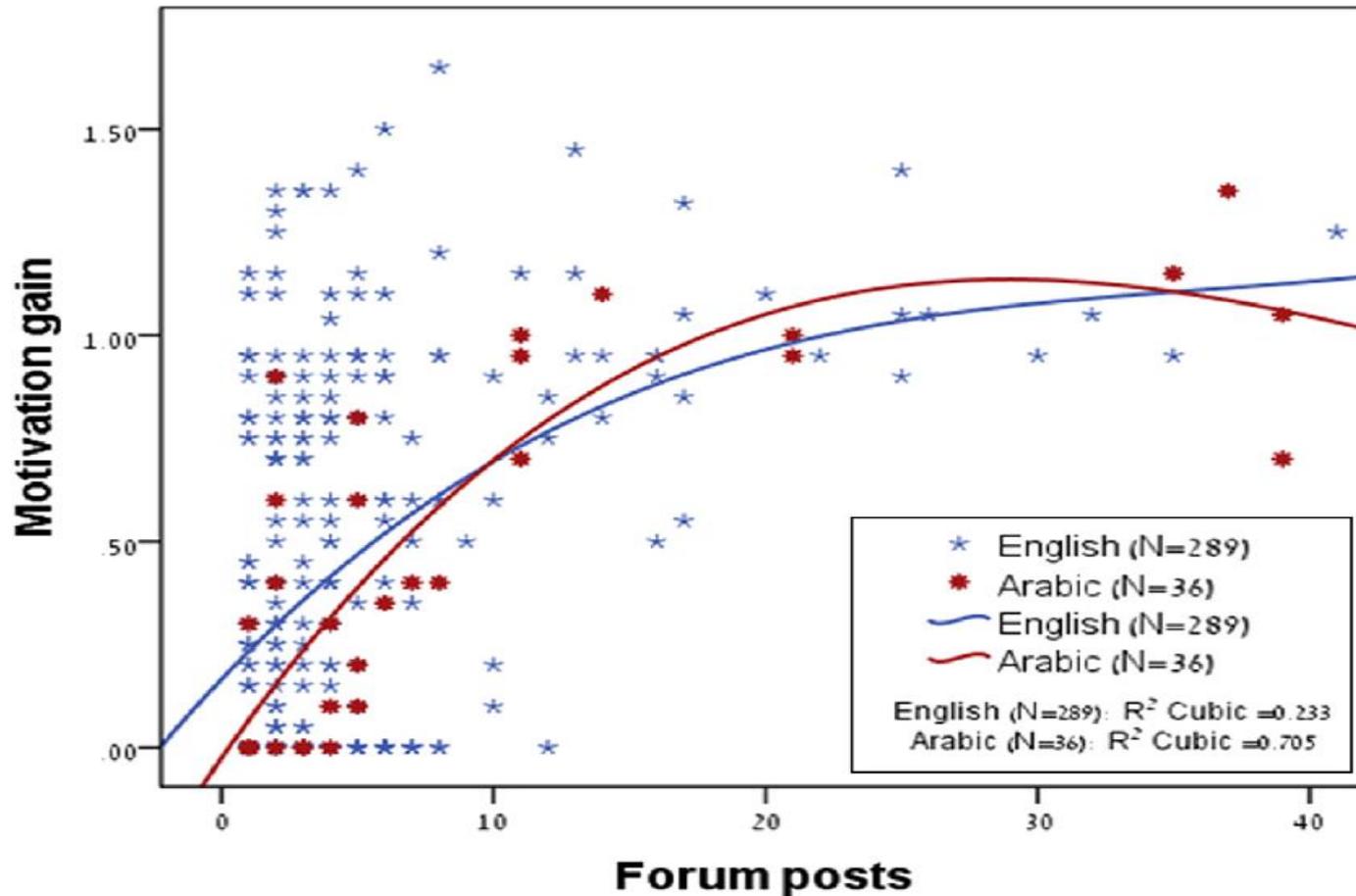
Weekly quizzes: $r = .99$ $p < .001$; $t = 6.30$ $p < .01$

Assignments: $r = .94$ $p < .05$; $t = 8.50$ $p < .01$

Significant correlations and differences:

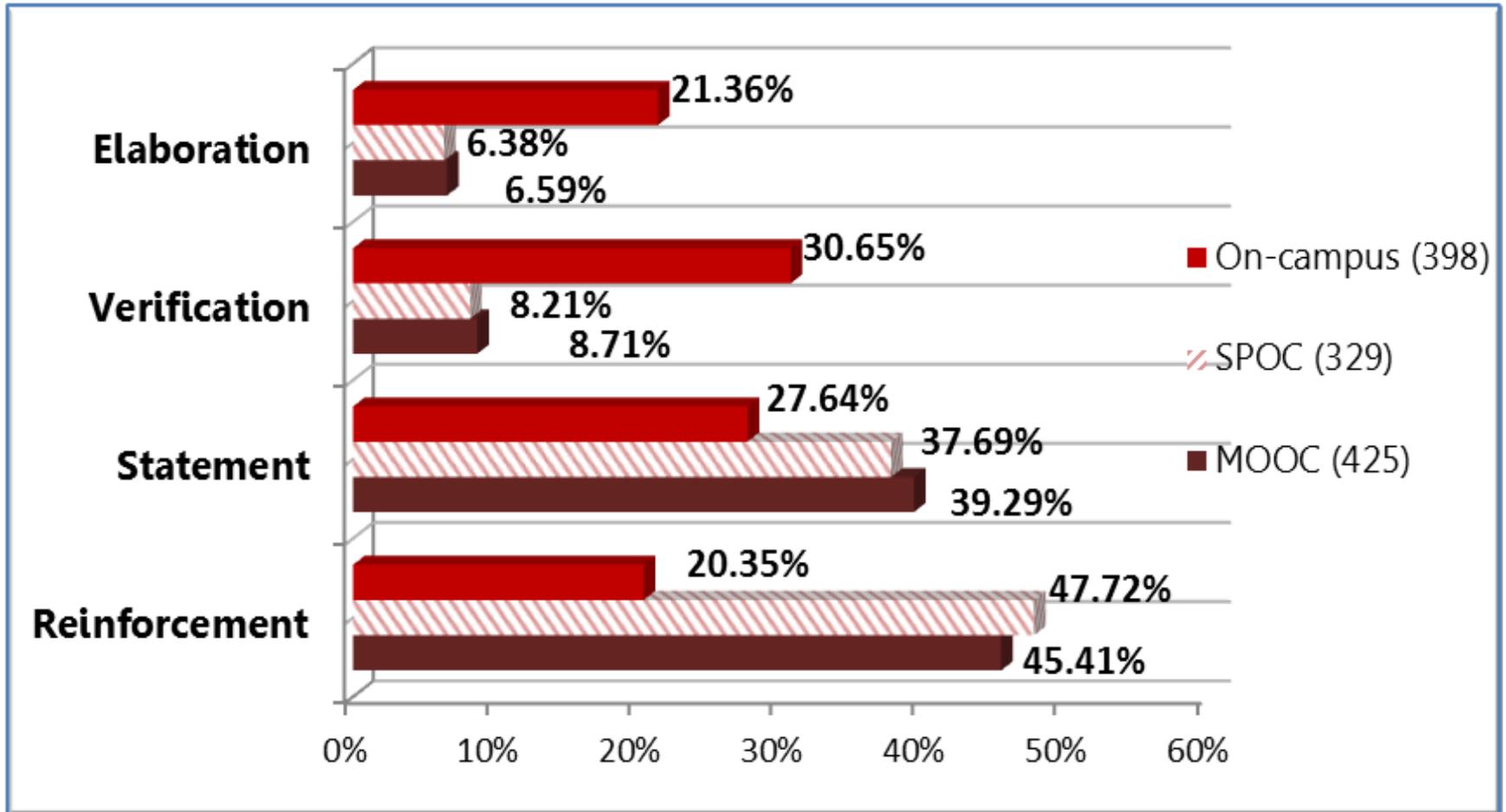
Similar engagement pattern

Deferent involvement /attrition level



Cubic regression model (Keele, 2008), indicated that the number of forum posts was a significant predictor for motivation gain in both the English and Arabic courses ($F(3, 285) = 28.80, p < .001, R^2 = .23$; $F(3, 32) = 25.51, p < .001, R^2 = .705$).

Peer feedback quality



1152 comment segments: on-campus ($M = 7.96$), SPOC ($M = 6.58$), MOOC ($M = 8.50$)

Peer grading accuracy

Number of projects graded

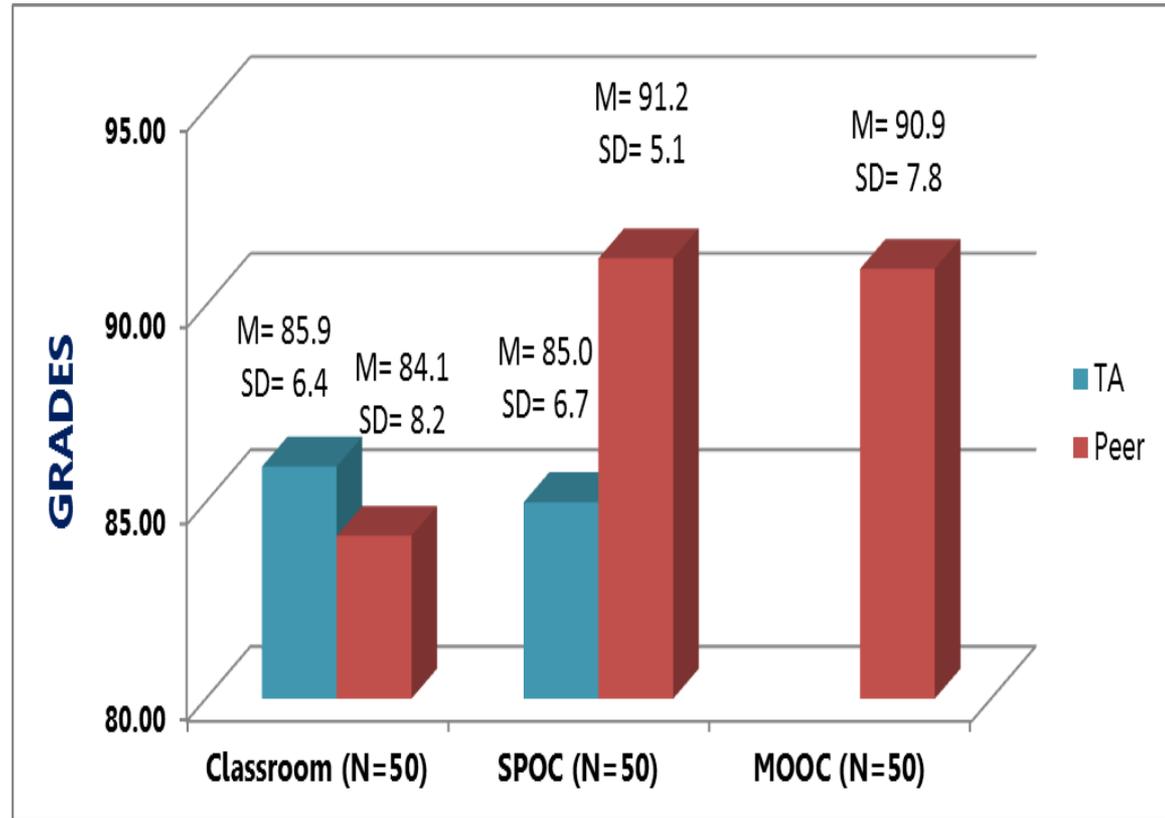
On-campus ($M = 3.00$)

SPOC ($M = 3.27$)

MOOC ($M = 5.26$)

On-campus students awarded lower grades compared to MOOC and SPOC students

$F(2,336) = 20.12, p < .001, \eta p^2 = .107$



However, their grades were correlated with those of the TAs ($rs(77) = .58, p < .001$)

Findings: Characteristics of MOOC Completers

Problem-solvers

Networkers

Benefactors

Innovation-seekers

Complementary-learners



Problem-solvers

From: Balaji [mailto:balaji_12@yahoo.com]

Sent: July 24, 2014 11:04 AM

To: hossam@technion.ac.il

Subject: Re: Course Certificates

Respected Prof. Hossam Haick,

Thank you very much for your wonderful course. I am really happy to have taken your course and got a lot of latest information. I am currently working in the area of ocular cancer research in India.

I would like to seek your expert advice and support for some research work. Although I am not an expert of your caliber, I have been working in the area of anti cancer research for past few years. Recently one of our work has been accepted for publication in Chem. Commun. and will appear in the inside front cover of the journal.

[A strain-promoted alkyne-azide cycloaddition \(SPAAC\) reaction of a novel EpCAM aptamer-fluorescent conjugate for imaging of cancer cells - Chemical Communications \(RSC Publishing\)](#)



A strain-promoted alkyne-azide cycloaddition (SPAAC) rea...

For the first time, a novel EpCAM aptamer (SYL3C)-DIBO-AF594 fluorescent conjugate was synthesised by bioorthogonal chemistry utilizing a strain promoted alkyne-azi...

[View on pubs.rsc.org](http://pubs.rsc.org)

Preview by Yahoo

Innovation-seekers

مرحبا بروفيسور

باسمي وباسم جميع زملائي في كورس التقانة والمستشعرات النانوية اتقدم بجزيل الشكر والامتنان والعرفان لك لكل ما قدمته لنا طيلة فترة الكورس من معلومات قيمة وشيقة حول هذا المجال الرائع ...
والشكر موصول لكل طاقم الادارة الذين رافقونا طيلة فترة الدراسة وقدموا لنا معلوماتهم القيمة وتجربتهم في هذا المجال
بالفعل لقد كان كورس اكثر من رائع وجدنا فيه كل ما نطمح اليه وتشوقنا لمعرفة حول المستشعرات والتقانة النانوية ...
اخيرا تقبلو منا كل الشكر والود والامتنان وبانتظار عطائكم المتجدد في كورس اخر ... لذلك الحين اقول لكم مزيد من العطاء
ودمتم بألف خير
تحياتي
فؤاد نمر

I and my colleagues, in the course of Nanotechnology and Nanosensors, would like to thank you a lot, for the significant valuable interesting and wonderful, information and knowledge that we have acquired/received during the course.

We also would like to thank the course team who accompanied us throughout the course, and shared with us his significant knowledge and his experience in this field.

Really the course was more than wonderful; we learned what we have expected and desired to learn about the field of Nanotechnology and Nanosensors

Finally, thank you again. .. Pending a renewed course

Sincerely,

Fouad Nimer

Benefactors



Robotic insect based-human odor sensor

Nanosensors for hearing aids

The block contains several images: a vintage microphone, a modern handheld microphone, a small black circular sensor, and a cylindrical mesh sensor. Below these is a diagram of the human ear with labels: External Ear Canal, Tympanic Membrane (Eardrum), Middle Ear Space, Eustachian Tube, Cochlea (Three ear bones), Vestibular Nerve, Cochlea (Hearing Coils), Hearing Nerve, Balance Nerve, and Vestibular Nerve. To the right are two SEM images of hair cells. At the bottom is a schematic of a nanosensor with labels: Acoustic wave input (air pressure wave) dB → MPa, Electrical signal output: ΔC, Diaphragm (=1 μm thick), Air gap (=2 μm), Backplate (=2 μm), Acoustic holes, and Pressure equalization hole.

Networkers

Denmark

Bsc Biochemistry

India

MSc Nano Science and
Technology

Costa Rica

BA English Language &
Literature

Saudi Arabia

BSc Laboratory
Medicine



The Synthetic Eye Project

**THE ONLY THING MORE
POWERFUL
THAN A BIG
IDEA**

**IS THE TEAM THAT
CAN SEE IT THROUGH**

Sigge Hermann, Naef Alduhaim, Jahnavi Jha, Lizeth Garcia G.

MAGEN DESIGN BY: LIZETH GARCIA GARCIA

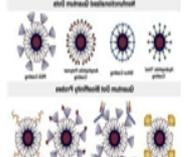
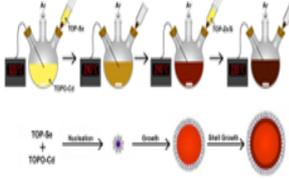
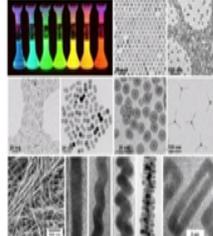
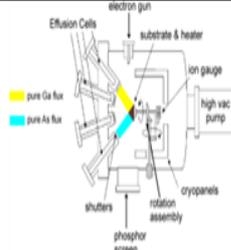
10 Lessons learned:

1. Investing resources in development
2. Short lectures (10 min)
3. Recording in a special studio
4. Visualization, animation
5. Usage permission and IPR
6. Adapting to a diverse audience
7. Resolving difficulties in advance
8. Diverse assessment (machine- and peer-grading)
9. Encouraging connectivity
10. Dividing the course (5 weeks)



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Nano images and figures	The website E-mail		Copyright permission/Notes
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	Bailey, <i>et al.</i> Physics E 2004	snie@emory.edu	Author -You have my permission to use these figures. ShumingNie
	Talapin and coworkers http://chemistry.uchicago.edu/faculty/faculty/person/member/dmitri-talapin.html	dvtalapin@uchicago.edu	Dear Abeer, I am happy to grant you the copyright permission for use of this image in your course. Best regards, Dmitri
	Bhattacharya <i>et al.</i> 2001 http://www.sciencedirect.com/science/article/pii/S0022024801006273	pkb@eecs.umich.edu	27.60 USD Translate to one language

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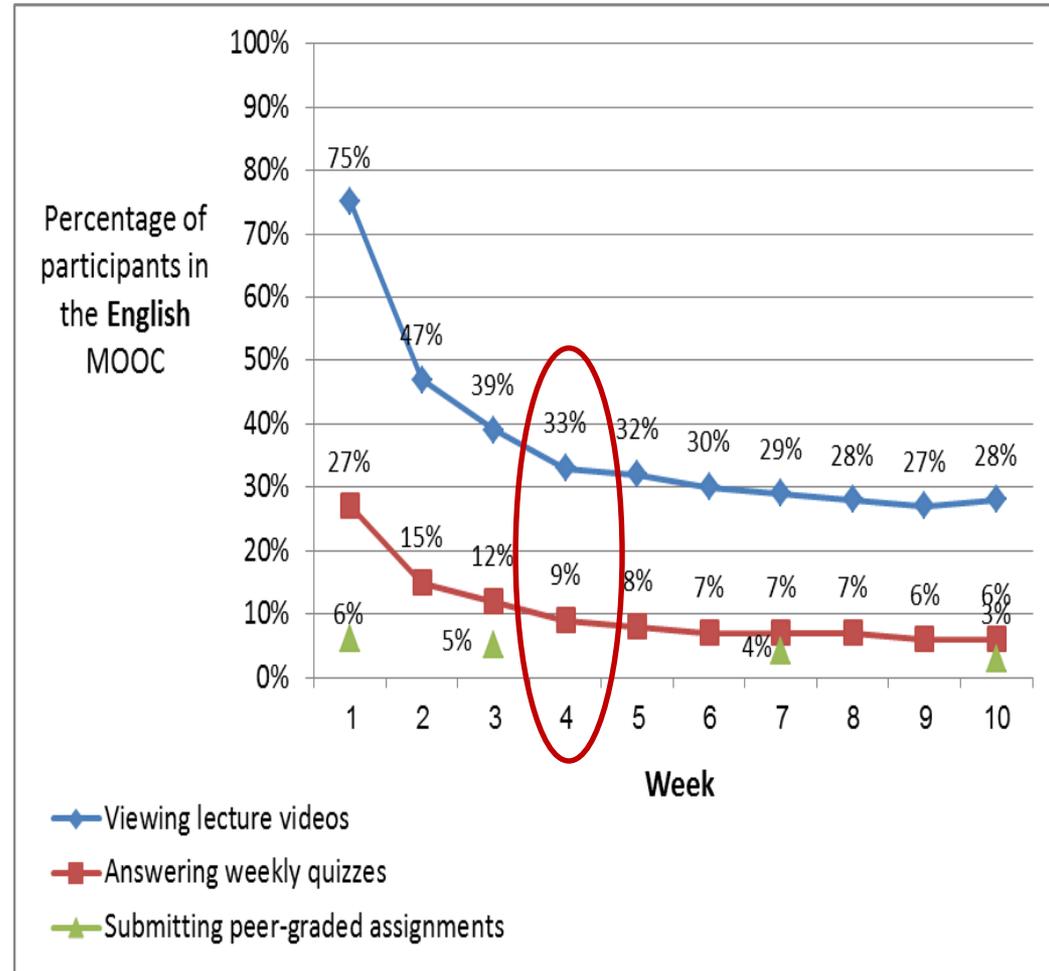
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MOOC: 6 Trends of 2016

1. From MOOC (cMOOC to xMOOC) to SPOC
2. From once a semester/year to on-demand/self-paced
3. From a structured framework to flexible submissions
4. From massive to cohorts
5. From free to fee (+accreditation)
6. From academic to professional education



Thanks

Miri Barak

bmiriam@technion.ac.il

The Faculty of Education in Science and Technology

