Default Question Block

Comparing Perceptions of Academic Engineering Educators and Classroom Technology Teachers
Round 1 research study survey – Items clustered into five categories.

INTRODUCTORY NOTE TO OUR EXPERT PANELISTS

Dear Colleagues,

Your assistance with this study is gratefully appreciated. The study has been designed to compare perceptions of post-secondary academic engineering educators and high school engineering and technology teachers relative to the concepts both groups feel high school graduates students should learn. This Delphi study will be conducted in three rounds. The timetable is shown below:

June 7 - Survey round one is conducted. Participants are asked to respond within two weeks.
June 21 - Survey round one responses are due. Analysis of round one responses begins.
July 19 - Survey round two is conducted with items modified as a result of panel suggestions. Participants are asked to respond within two weeks.
August 2 - Survey round two responses are due. Analysis of round two responses begins.
August 30 - Survey round three is conducted with items modified as a result of panel and BGU suggestions. Participants are asked to respond within two weeks.
September 16 - Survey round three responses are due. Analysis of round three responses begins.

Before starting the actual survey, we are asking you to complete a section that provides demographic information. Your name and affiliation will remain anonymous until the end of the study, at which time you will be asked if you would like your name included when results are disseminated. The demographic section will be much shorter in the two subsequent rounds since most information is needed only once.

A section entitled "Survey Explanation and Guidance" appears just below the demographic section.

Thank you sincerely,

Michael Hacker, Researcher, (Hofstra University)
Moshe Barak, Ph.D., Research Supervisor, Ben Gurion University, Beersheva, Israel)

Demographic Section:

Name (This will remain anonymous except to the researcher)

Institution (This will remain anonymous except to the researcher)

Please indicate whether your institution is private or public

- ○ Private
- ○ Public

State in which you're located:

Contact Information (This will remain anonymous except to the researcher)

Email Address	
Telephone Number	

Into which of the two study groups do you (or did you) best fit: Note: Please be sure to pick one of these two study groups.

- ○ Post-Secondary Academic Engineering Educator
- ○ Secondary School Classroom Technology Teacher

Please indicate how many years of educational experience you have.

- ○ 0-5
- ○ 5-10
- ○ 10-15
- ○ 15-20
- ○ 20-25
- ○ More than 25

Please indicate your primary position/role within your institution.

- ○ Post-secondary Engineering Educator
- ○ Community College Faculty Member
- ○ Other Post-secondary Responsibility (Please describe)
- ○ Secondary School Engineering or Technology Teacher
- ○ Other Secondary School STEM Teacher (Please specify subject taught)
- ○ Retired secondary school teacher
- ○ Retired post-secondary faculty member

Please indicate the title of the primary course that you typically teach. If you are not presently teaching or have not been teaching for five years or more, please leave this field blank.

Please indicate whether you have conducted workshops for K-12 teachers within the last three years.

- ○ Yes
- ○ No

What is your gender?

- ○ Female
- ○ Male

Please indicate the highest level of education you have completed.

- ○ Some College
- ○ Two-Year College Associates Degree
- ○ College Graduate, Bachelor's Degree
- ○ Master's Degree
- ○ Doctoral Degree (EdD or PhD)
- ○ Professional Degree (MD, JD, etc.)
- ○ Other

Please describe your prior participation in initiatives linking engineering and K-12 education.

If you have published recent research papers or journal articles, please list them here.

If you have been involved in recent funded projects, please list them here.

SURVEY EXPLANATION AND GUIDANCE

This survey is intended to determine which competencies related to engineering and technology are most important for all students in the United States to attain by the time they graduate from high school.

These competencies are not intended to be of specific value only for students who would pursue careers in engineering or technology; rather, they are competencies **all** students should assimilate as part of their fundamental education.

For each of the following survey items please indicate how important you believe the competency is for all high school graduates in the United States to attain. You would rate an item to be important if you believed that it reflects key knowledge or skill, fundamental principles, organizing concepts, significant ideas, major standards or benchmarks, generalizable ideas, or common themes. You would rate an item not to be important if you believed it to be trivial, too complicated for most high school students, or necessitating too many resources (e.g., instructional time, teacher knowledge, facilities, etc.).

You are asked to rate each item on a seven-point scale where (7) indicates that you strongly agree that the item is important and (1) indicates that you strongly disagree that the item is important. After you respond to each item you have an opportunity to suggest re-wording of the item, suggest deletions, and suggest other competencies that should be added.

Competencies have been clustered into five content categories in engineering and technology education that prior research has shown to be overarching: **design**, **modeling**, **systems**, **resources**, and **human values**. As this study limits student competencies to these five categories, please be kind enough to restrict new item suggestions to concepts or skills that you believe fall within them.

If you do wish to suggest a new item related to any of the five content categories, please state that item in behavioral terms (for example students will "model," "design," "evaluate," "create," etc.) as opposed to saying that students will "understand." Additionally, as this research is focused on identifying the most salient and transferrable ideas in engineering and technology education, please ensure that any items suggested for addition are not too technically specific or too atomistic in nature.

DESIGN:

To demonstrate knowledge of important engineering and technology concepts and skills, upon graduation from high school students will be able to demonstrate engineering design capability as follows:

D1. Iteratively design and construct a product, system, process, or environment that meets given constraints and performance criteria.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

D2. Solve engineering design problems by appropriately applying scientific concepts.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

D3. Solve engineering design problems by appropriately applying mathematical concepts.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

D4. Optimize an engineering design by making and evaluating trade-offs to address design criteria and constraints.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

D5. Give an example of where making a design decision about the use of a particular engineering approach to problem solving involves weighing trade-offs between positive and negative impacts..

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

D6. Articulate the reasoning behind engineering design decisions using verbal and/or visual means (e.g., writing, drawing, making 3D models, using computer simulations).

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

D7. Engage in a socially conscious design activity that relates to a community-based or global issue (such as providing potable water, or improving food production or preservation).

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

D8. Provide an example of how technological design can help people with special needs and disabilities.

Strongly Agree	Agree	Moderately Agree	Indifferent	Moderately Disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

In the box below, please add any further competencies related to **DESIGN** that you believe are important for ALL high school students to learn as part of their fundamental education. Remember that these competencies should reflect OVERARCHING ideas, not atomistic competencies and should be those that ALL high school graduates should learn, not just students pursuing careers in engineering or technology.

If you do suggest a new item related to DESIGN, please state that item in behavioral terms (for example students will "design," "evaluate," "engage in," etc. as opposed to saying that students will "understand".

MODELING:

To demonstrate knowledge of important engineering and technology concepts and skills upon graduation from high school, students will be able to demonstrate modeling capability as follows:

M1. Use representational modeling (e.g., a drawing or a simulation) to accurately depict a design.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

M2. Develop and test a prototypical scale model of a design to analyze its strengths and limitations.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

M3. Use mathematical modeling (e.g., using the equation for conductive heat flow, $Q=kA\Delta T/L$, to design a shelter) to quantitatively describe and predict the effects of variables on a design.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

M4. Use simulation software to investigate complex systems and issues.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

M5. Create and test a physical model of an artifact, process, or system using tools and materials to ensure that a design solution meets given criteria and constraints.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

M6. Create and test a virtual model of an artifact, process, or system using simulation software to ensure that a design solution meets given criteria and constraints.

Strongly agree	Agree	Moderately Agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

In the box below, please add any further competencies related to **MODELING** that you believe are important for ALL high school students to learn as part of their fundamental education. Remember that these competencies should reflect OVERARCHING ideas, not atomistic competencies and should be those that ALL high school graduates should learn, not just students pursuing careers in engineering or technology.

If you do suggest a new item related to MODELING, please state that item in behavioral terms (for example students will "model," "evaluate," "create," etc. as opposed to saying that students will "understand".

SYSTEMS:

To demonstrate knowledge of important engineering and technology concepts and skills upon graduation from high school, students will be able to demonstrate systems thinking as follows:

S1. Label and explain a systems diagram of a familiar technological system (e.g., a home heating system) that specifies inputs, processes, outputs, feedback, and control components.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

S2. Identify and explain the function of the interacting subsystems that comprise a more complex system.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

S3. Explain the effects and differences between negative and positive feedback in a technological system.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

S4. Construct, test, and explain the operation of a system composed of several subsystems to accomplish a given goal.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

S5. Explain the difference between an open-loop control system and a closed-loop control system and give an example of each.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

In the box below, please add any further competencies related to **SYSTEMS** that you believe are important for ALL high school students to learn as part of their fundamental education. Remember that these competencies should reflect OVERARCHING ideas, not atomistic competencies and should be those that ALL high school graduates should learn, not just students pursuing careers in engineering or technology.

If you do suggest a new item related to SYSTEMS, please state that item in behavioral terms (for example students will "model," "explain," "construct," etc. as opposed to saying that students will "understand".

RESOURCES:

To demonstrate knowledge of important engineering and technology concepts and skills upon graduation from high school, students will be able to demonstrate capability in selecting and using resources as follows:

R1. Identify resource categories that technological systems use to turn desired results into actual results as capital, energy, information, materials, time, and tools.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions..

R2. Select and use appropriate material, energy, and information, tools, and processes to accomplish desired technological results safely, economically, and efficiently.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

R3. Evaluate technological and scientific information for accuracy, and authenticity of sources.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

R4. Safely and correctly use tools and machines to produce a desired product or system.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

R5. Advocate and practice safe, legal, and responsible use of information and communications technology.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

R6. Identify, discuss, and practice privacy issues involved in using information resources.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

R7. Identify and discuss safety issues involved in implementing an engineering project.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

In the box below, please add any further competencies related to **RESOURCES** that you believe are important for ALL high school students to learn as part of their fundamental education. Remember that these competencies should reflect OVERARCHING ideas, not atomistic competencies and should be those that ALL high school graduates should learn, not just students pursuing careers in engineering or technology.

If you do suggest a new item related to RESOURCES, please state that item in behavioral terms (for example students will "select," "use," "identify," etc. as opposed to saying that students will "understand".

HUMAN VALUES:

To demonstrate knowledge of important engineering and technology concepts and skills upon graduation from high school, students will be able to demonstrate consideration of human values in proposing solutions to engineering and technological problems as follows:

HV1. Explain, using examples, how intelligent information technology (e.g., artificial intelligence, image enhancement and analysis, sophisticated modeling and simulation) is transforming the world of information and knowledge, with profound effects on society.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

HV2. Redesign an engineering design solution to increase sustainability.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

HV3. Explain and give an example of how different cultures' engineering design solutions vary based upon the desire to satisfy their cultural values.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

HV4. Give an example of a tradeoff a company might make between profitability and environmental, health, or safety concerns.

Strongly agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

HV5. Effectively use social media (e.g., Facebook, Instagram, Twitter) without violating accepted social norms (e.g., not posting personally offensive/rude posts about a person, inappropriate images, or engaging in verbal "fights.")

Strongly Agree	Agree	Moderately agree	Indifferent	Moderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

HV6. Consider human factors (ergonomics, safety, matching designs to human and environmental needs) when proposing design solutions.

Strongly Agree	Agree	Moderately agree	Indifferent	Monderately disagree	Disagree	Strongly disagree
○	○	○	○	○	○	○

Comments and Changes: If you wish, please suggest re-wording or deletion of the item above, and provide a short rationale for your suggestions.

In the box below, please add any further competencies related to **HUMAN VALUES** that you believe are important for ALL high school students to learn as part of their fundamental education. Remember that these competencies should reflect OVERARCHING ideas, not atomistic competencies and should be those that ALL high school graduates should learn, not just students pursuing careers in engineering or technology.

If you do suggest a new item related to HUMAN VALUES, please state that item in behavioral terms (for example students will "explain," "identify," "provide examples," etc. as opposed to saying that students will "understand".