

## Women in engineering: Interests, perspectives, confidence...and experiences

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### *Luncheon keynote discussion notes*

Given the Academic Pathways Study (APS) findings presented during the keynote talk, audience members were asked to consider how the interests, perspectives, and confidence of women studying engineering might interact with their educational experiences.

Question #1: How might women's interests, perspectives, and confidence affect their experiences as engineering undergraduates?

Question #2: Conversely, how might their experiences affect their interests, perspectives, and confidence?

Transcribed, anonymized responses, along with any additional notes, are shown below (one row per person).

For more information about the Center for the Advancement for Engineering Education and the Academic Pathways Study, please visit our web site at <http://www.engr.washington.edu/caee/>.

Response #1	Response #2	Other remarks
For the most part, the expressions of confidence women may have may not result in the same reaction from faculty & peers (and others). We know from sociological studies of gender that women are "allowed" less variability in expressing assertiveness, etc. (and perhaps the men are <u>over</u> -confident, unrealistically so). Those less confident (perhaps as a result of subtle feedback endemic in our society) will feel less authentic, less comfortable in an engineering setting.	Subtle bias, stereotype threats, etc. will influence self-assessment of performance. Thus, without credible domain-specific feedback (e.g., from faculty or other professionals in engineering), women will tend to underestimate their capabilities relative to men's self-assessment---with consequences for retention in engineering.	Since we ran out of time, here's a comment on how to present these findings in a way that doesn't reinforce stereotypes: Think of trying to figure out how the findings help support desired changes in engineering education---maybe look at The Engineering of 2020 and suggest how findings (not leading with gender differences) indicate students are aligned with the goals of achieving the Engineer of 2020...and then mention those factors where women seem to exemplify to an even greater [extent] than men the desired directions toward reaching the goals of engineering education.
When and how do we let it, other than through their extracurriculars, service projects, or some research? These are the places where they have true choice to let their differences give their overall experience meaning.	We say we want diversity, but do we really? Women do bring diverse perspectives, but our educational system creates engineers who all have to know/do the same stuff. So, our processes devalue and squeeze out the diversity. This has to have a negative effect on the things they value and consequently on their overall assessment of their experiences.	We are making sausage. We take different stuff, put it through a grinder, mix it together, discard stuff that shouldn't be in sausage, and shove out a fairly uniform product. ← which is what you want for sausage, but not for engineers

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Response #1	Response #2	Other remarks
<p>Women’s interests, perspectives, and confidence is not aligned with some schools’ engineering curriculum and/or programs. Engineering curriculum is taught and delivered in a linear manner, where women’s interests, perspectives, and confidence are, for some, not linear → we are different, think differently than our male counterparts (spaghetti – women’s brain, waffles – men’s brain)</p>	<p>Their experiences should be reinforced as positive contributions (rather than different or strange). Engineering education needs to be approached holistically. There must be a relationship between level of self-esteem that affects their interests, perspectives, and confidence---perhaps the men played more competitive, team sports?</p>	
<p>With the values that women have in all those areas: I would suspect how they succeed in engineering will be in large part based on the relationships they have with their professors, ability to balance their courseload and other elements.</p>	<p>If they are not getting the support (pertaining to coursework and study) they need while in school, they may flee from engineering upon graduation.</p>	
<p>→ slide, balancing for women, ↓ GPA How did you correlate for men? I have 2 boys. Both attended D-1 schools and played on D-1 football/baseball team.</p>	<p>Balancing <u>same</u> issue Maybe boys/men bring it up and discuss or complain about it a lot <u>less</u>.</p>	
<p>Women bring broader interests than men to engineering (environmental, social, cultural) and may find the engineering curriculum restrictive, not allowing them to explore their varied interests.</p>	<p>If women’s experience in the engineering classroom does not value the perspectives they bring, they may feel alienated and lose interest and confidence in engineering.</p>	
<p>1) Bring more social relevant examples into the classroom 2) Allow women students to work in teams with other women students. 3) Recognize accomplishments of women in classroom so all students are aware 4) Bring industry with real problems to present in classroom – environmental firms</p>	<p>1) Women are more socially aware and want to work on issues that help humanity. Focus on these types of problems in the engineering classroom.</p>	

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<p>Interests in EC activities don’t appear to be stereotypically “engineering” protocol. So women’s outside interest could negatively impact their experiences as undergrads. These interests might make them unique engineers (and students) however.</p>	<p>Their experiences as eng. Undergrads might force them to curb their interest in EC activities or to not talk about/reveal these interests to others.</p>	
<ul style="list-style-type: none"> <li>- Attrition – leaving engineering, persistence</li> <li>- Satisfaction with instructors, teaching environment</li> </ul>	<ul style="list-style-type: none"> <li>- Positive experience may lead to persistence beyond BS – gap into engineering workforce</li> <li>- Overcome lack of confidence</li> </ul>	
<p>Confidence (most critical). Confidence level of women in undergraduate engineering programs mirror the “freshmen attitudes report” done by Noel-Levitz (2007), which assessed high school female students’ perception of their math skills, which conversely relate to their motivation to complete school successfully. I believe that interest can be strengthened and perspective can be changed, but confidence is an attribute that must be developed.</p>	<p>Experiences – vicarious or personal -&gt; greatly influence the degree to which interests might be developed and access to information needed for changes for perspectives.</p>	
	<p>Solid performance in the face of their own reported lack of confidence should increase confidence – need to acknowledge their solid performance (note – male confidence often outstrips performance, while female performance often higher than their confidence).</p>	
<p>Undermine their own abilities to then not continue to higher degrees</p>	<p>Be exceptional teachers/mentors</p>	

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<ul style="list-style-type: none"> <li>- Women are interested in "broad" issues but work mostly on details in coursework.</li> <li>- Women students are concerned about balancing parenthood &amp; marriage with the hard work requiring their focus at the job.</li> <li>- Women's low confidence makes the engineering education experience "feel" worse than it feels for men.</li> </ul>	<ul style="list-style-type: none"> <li>- Women who persist to become engineers realize they can change the world faster than people who majored in something other than engineering.</li> </ul>	
<p>The context of why they are pursuing an engineering degree:</p> <ul style="list-style-type: none"> <li>- Goals of impact on society</li> <li>- Personal ambitions</li> <li>- Sense of a community</li> </ul>	<ul style="list-style-type: none"> <li>- Reinforcement of interest and choice of engineering as an appropriate choice.</li> <li>- Practical/co-op experience may encourage or discourage experience/pursuit of engineering</li> </ul>	
<p>They have broad interest but courses and experiences are narrowly focused -&gt; less satisfaction. Interest in "softer" side of engineering not reflected in experiences so less satisfaction.</p>	<p>Narrow focus of course/lab projects -&gt; decrease in interest Mismatch between interest and curriculum -&gt; lower confidence Working with mostly male peers may lead them to believe their inclusion of broad issues is "wrong" -&gt; lower confidence and cause them to narrow their inclusiveness.</p>	
<p>Lower presence/respect for some women's interests sends messages that women shouldn't "be here." Lack of positive feedback about some women's interests accrues in time into lowered confidence and more negative experiences (see Tonso 2007, "On the Outskirts of Engineering" for a raft of empirical evidence to support these cases...) ☺</p>	<p>Some men's (students and faculty) persistent comments signal that women aren't supposed to "be here" send clear messages that ultimately diminishes their desire to persist as engineer. As one of Seymour and Hewitt's students noted, "I am encouraged to leave by discouragement." And, my "Marianne" whose prof told her she couldn't defend her vantage point in a sense that she was the case that proved their point. (about how "girls" only want to get married). Actually, I had hoped that you would empirically study these aspects that we are commenting on...</p>	<p>My larger issue is: what empirical evidence do you/your study have that men and women are meaningful categories? Also this info really tells an important story that women's engineering IS qualitatively different AND THEN BE SURE TO NOTE THAT THIS IS OK! However, some (considerable actually) within groups analyze/comparison is needed for amplify how men vary from other men and women vary from other women.  Brava!</p>

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<p>ON most campuses, women represent less than 20% students studying engr, but more than 50% participating in leadership activities on campus.</p>	<p>Since women need and value community, “balancing” often means cutting back on the extracurriculars which further isolates women.</p>	
<p>Do women in other majors do more extracurricular activities than men? Don’t want them to drop their extracurricular activities if they feel overwhelmed – so maybe more co-op experience for credit?</p>	<p>More successful experience = more confidence.</p> <ul style="list-style-type: none"> <li>• Saw a presentation at ASEE (can’t remember which one right now) that discussed doing pro-college engineering design beginning in first grade: ended with “can you imagine what senior capstone design projects would look like?”</li> <li>• Give all students more experience with design lets both boys and girls do all types of design activities (stereotypically male and female activities)</li> </ul>	
<p>What are their interests or focuses?</p> <ul style="list-style-type: none"> <li>- Environment</li> <li>- Health/safety</li> <li>- Technology</li> </ul>	<p>Gendered childhood play (dolls/house/socialized vs. construction/legos)</p>	
<p>Women bringing broader perspectives in might feel devalued, frustrated, and dissonant with a curricular structure that focuses on narrow facets at a time without integration across the coursework.</p> <p>Women without experience tinkering think all the guys know all about instruments and machines when these days none or few of the students do.</p>	<p>Foregrounding the professional outcomes from ABET would validate the female perspectives shown in the data, and would bring more importance to those aspects among males (sorry, trying to listen, write, think at same time! Hope makes sense!!)</p>	

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<p>Not an engineer! So I’m not really qualified!</p> <p>Choice of specialty field and courses. Choice of degree of participation in social issues pre-professional groups. Internships? (is this common in engineering??) or opportunity to participate in a faculty research lab.</p> <p>Likelihood of seeking mentors (peer or older)</p>	<p>Successful internship or practical experience could increase confidence.</p> <p>Getting “dissed” by male peers or faculty -&gt; decrease confidence in engineering.</p>	
<p>Leave engineering due to perception of lack of support in encouraging their diverse interests. They may need to work harder to “sell” their connections of their diverse interest to engineering.</p>	<p>Everything is affected by engineers and engineering, so we owe it to all students to provide a variety of engineering examples/experiences.</p>	
<p>Determines major participation level and types of experiences chosen.</p>	<p>Positive or negative experiences change perspectives, interest and confidence levels – could lead to persistence or drop out or major change. Also determines professional choices after graduation.</p>	
<p>Female perspectives on design processes affords expended opportunities</p>		
<p>They may be more/less likely to volunteer for a variety of extracurricular activities.</p> <p>They may be more/less willing to speak up in class/lab.</p> <p>Set expectations unrealistically high.</p>	<p>Success improves confidence/interest. Working in unfamiliar context can increase perspective.</p>	

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<p>If neglected, women’s beliefs and confidence will be unsupported and dissuade them from the value of engineering. They may not/probably not practice as engineers. This is the chilly climate. Perceptions are important to women – especially to know that their own are valued by others.</p>	<p>With positive experiences, interest, perspectives and confidence grow. They’re more empowered to accomplish more. In our first year Engineering Projects class, we form teams based on social styles (not gender! Though an all women’s class could be cool) and then we rotate “roles” and finally, I have each person take a skills leadership and teaching role on design skills, and everyone learns something new. Call me to discuss! [phone number removed]</p>	<p>Also, check out our first year Engineering Design Course retention data. We show a consistent increase in retention over the years vs those who do not take this course. Go to <a href="http://itll.colorado.edu">itll.colorado.edu</a> and find “papers.”</p>
<ol style="list-style-type: none"> <li>1. From data, women are less confident in solving open-ended problem solving.</li> <li>2. From data, women would take into account more design factors (from a broad perspective and close perspective)</li> </ol> <p>So – my question is, are these related to each other and to the finding that women are more overwhelmed in engineering studies? This is, are women less confident because they see the problems as more complex than the men, which also might contribute to their feelings of being overwhelmed.</p>		
<p>Their interest-broad contexts – not emphasized in curriculums, negative impact. Confidence – have less and less hands-on experience, spatial reasoning – negative impact.</p>	<p>Narrow view – less broad participation.</p>	
<p>If externally supported to achieve and provided with information of interest they may have a more positive experience.</p>	<p>If through experience they find a passion it might increase their confidence and interest.</p>	

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<p>If they don’t have a deep interest in what they are doing (went into Eng. For wrong reason money, family pressure, etc.) they won’t do well. If subject matter does not have a direct connection to “making a difference” they may not find it important.</p>	<p>Negative experience such as gender discrimination or not making a connection can wreck their confidence.</p>	
<p>If their interests are what labs/class activities/HW assignments/career education is around then experience would be more positive. I think increased confidence results in a more positive perspective of eng.</p>	<p>Vice versa down here... if a teacher says “you don’t belong here” confidence drops etc.</p>	
<p>Women’s interest focus on more social impacts -&gt; this may become increasingly important with changing focus on environmental/social concerns and impacts. Conf -&gt; al see the lower conf levels as interesting because perhaps the role of mentors can counteract the lower conf in other areas</p>	<p>Lack of role models, mentors, or other successful women could negatively affect their interest, perspectives and confidence.</p>	
<p>They may think they are alone with respect to perspective and confidence if they don’t have peer or other mentors going though same experiences.</p>		
<ul style="list-style-type: none"> <li>➔ Interests: need for connecting career to societal interests; need to social connection</li> <li>➔ Perspectives:</li> <li>➔ Confidence: low confidence may limit career potential</li> </ul>		



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<p>Women’s lower confidence in their abilities are likely to increase the probability that they will leave an engineering major. If women’s broader perspective and interest (as described in the APS study) are not addressed in engineering classes, women may feel less engaged with engineering.</p>	<p>If they are encouraged by their professors, their confidence may increase. Their experiences in engineering school may spark other interests in engineering – they may learn about engineering application they hadn’t know before. On the other hand, if their experience in engineering school does not open new options for them, ie are more narrow, their interest and confidence that engineering is a good fit for them may decline.</p>	
<p>I think women who are introduced to engineering (ie what the study of engineering is, who and where are engineers) later in their secondary education and/or early in their college career will be less confident and less likely to express an interest in engineering.</p>		
<p>Females tend to have babysitting jobs in their teen years which may lead to their nurturing and broader (human) experience.</p>		
<p>Sometimes women who become too interested in activities/organizations their gpas fall and they are less confident/successful in the courses.</p>	<p>On the other hand, some students gain confidence in their ability to earn engineering degrees as they assume leadership roles in student groups</p>	
<p>Women’s interests and perspectives can help broaden and diversify applications of engineering and keep them in pipeline if they felt their views are adding value. However, general lack (or lesser) confidence can create greater struggles for women in pipeline and they may not feel their “diverse” views are valued or applicable, thus making it easier to drop out or change majors.</p>	<p>If women have strong, positives experience in undergrad where they are validated and feel their view are contributing to engineering, it can help them stay in their major and keep their interest going, as well as provide further fuel to their confidence to continue contributing their perspective and input.</p>	

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<p>With less confidence, women might find it harder to persevere through challenging courses and might consider change majors. In projects that are team-based, they might feel that their perspectives and interests aren’t represented and it might be harder to speak up.</p>	<p>If they’ve had less experience tinkering they might have less confidence.</p>	
	<p>If women have negative experiences, then their interests... and confidence will be negative as well. Whereas if they have positive experiences they will be more interested and have more confidence.</p>	
<p>If valuable perspectives/interests are validated in experience (eg value of female broader perspective), then women’s interests, perspectives and confidence will enhance their educational experience. Conversely, if these are not validated, or are disconnected, this could -&gt; will result in a negative experience for women.</p>	<p>Their experiences should help to both focus and broaden their interests, perspectives and confidence.</p>	
<p>Importance that they don’t have to be perfect at every class. Women feel less confident than men in classes even though they may be doing better academically.</p>	<p>Positive experience and having a support network will allow women to persist in engineering.</p>	
<p>Involving them in applied research projects early on could affect their experience as undergraduates.</p>	<p>Any experience in engineering work could broaden their horizon and guide them in forming their engineering career.</p>	
<p>These things affect their retention in engineering.</p>	<p>They need to see that their career affects their interest (such as helping others, changing the world).</p>	
<p>-social helping – EPICS w/o borders                      -first and second year curriculum engages or turns off                      -perspectives on engr as a careers                      -lack of alignment cause for departure from the field</p>	<p>-curriculum aspects turn off students                      -confidence that low already easier to dissuade – even if more of perception than truth</p>	

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<p>On the finding that women think more broadly in design, the communication in the team must be brutal on confidence. We know women are not listened to and men repeat their ideas. If a woman wants to talk about access and neighborhood, the men would tell them it’s superfluous to cost and materials. This must share their confidence in their abilities.</p>	<p>Then in turn, why would they want to continue engr when anyone can build equipment under budget? Vicious circle. Faculty could lead discussions first and model engr considers broad issues before giving to teams. May validate broad thinkers (mean and women) to make argument for better retention of women and other broad thinkers.</p>	
<p>Some of their strength may not be valued and weaknesses more valued which can amplify their loss of confidence. Also, they are forced to adapt. If interests are not satisfied in early years, they leave.</p>	<p>They may lose interest Change perspective or as data shows become even broader in their perspective (yr 1 women think more broadly than y4 men from the data!)</p>	<p>Confidence will return when they master the “normative” skills</p>
<p>Less confidence in math abilities translates to lower likelihood of success in rigid “gatekeeper” courses and a highly competitive environment.</p>	<p>Engineering undergraduate curricula in general are very rigid, defined and comprehensive. This means that students who may wish to pursue additional options are unable to do so, which probably contributes to the overburdened feeling of women students.</p>	
<p>Speaking from personal experience, my experience as an engineering undergraduate was that I was different than everyone else, that I had to prove myself to gain respect, that I was on my own. I was a leader in our engineering school and felt I needed to keep up many leadership activities and many classes to be accepted in the engineering community. My experience was: stress, little sleep, non-stop work, juggling many activities, achieving many things and still feeling it wasn’t enough.</p>	<p>Providing empowering messages and activities to women throughout curriculum could boost confidence and intensity and promote the idea that their perspectives make an important difference. They are the ones to make the difference.</p>	

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<p>Women often take things more personally and assume one mistake, or one C, means they are not qualified to be an engineering and drop out. Messaging matters and requiring student to go through the paces before giving them the big picture may cause some to opt out. Women who elect to go into engineering already have developed an “outer shell” to deal with the environment. Order of curriculum matter!</p>	<p>Teachers who pride themselves on weed-out courses should be counseled, or removed. Teachers still hold the key to making or breaking a student’s self-confidence and they should be aware of that and be trained in how to help students develop self-confidence.</p>	
<p>-Make programs “cool” and “interesting” -increase “confidence” in women -campaign for better work life balance with technical and engineering films.</p>	<p>-The experience needs to be very interesting -It has to relate to real life problems. -WE MUST INCREASE CONFIDENCE LEVEL IN WOMEN.</p>	
<p>Women tend to include broader considerations – this is important to improve the quality of design – let’s encourage this!</p>	<p>We must address why women’s confidence is low! Why is this, if women student’s have higher grades, participate in student organizations, ie if their performance is higher why is their confidence.</p>	
<p>Women have much to offer because of their interests and experiences in terms of design and implementation that we might not consider, but their lack or limited confidence may hinder their willingness to speak up or in fact be heard.</p>	<p>Experiences in engineering program? If yes, I can imagine that their experiences will in fact lessen all three.</p>	

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<p>From my experience as first year advisor at Purdue 1978 – 2000: the way they interpret negative experiences – bad grade on first physics test                      Eg female earns 52 on physics test, says “I’m probably not cut out to be an engineer.”                      Male earns 52 on physics test, says “The test was ridiculous; the professor is an idiot.”</p>	<p>If prof would control aggressive behavior of a few what males in the classroom; others would feel more engaged and probably have increase confidence and sustain interest.                      E.g. Faculty member set expectation at the beginning of the semester that when she/he asks questions, she/he will wait five seconds and then call on a student who has raised hand. Stops aggressive male from shouting out answer before others have an opportunity to consider a response.                      *I would like to receive slides of findings and the appropriate attribution to use for the research team when I show a slide</p>	
<p>Participation in external extracurricular organizations, while critically important, socially for women, may take time away from focusing on GPA.</p>	<p>Broader perspective from broader interests will help engineers be more innovative and more comprehensive in their problem solving.</p>	
<p>The complexity of these issues cannot be overstated. Clearly women bring so many positive things to eng. Not only in terms of their gender identity, but also in the many intersections of their diverse identities and experiences. At the same time, women’s confidence concerns may and I guess do have an impact on their motivation to and success in eng. Programs. Clearly, even if women are performing similarly to men their perceptions of success influences their desires to stay in engineering fields.</p>	<p>We have to embrace that women like men have broad experiences that influence them in choosing, staying (or not) and hopefully thrive in engineering. Reaching out to the broad interests in key.</p>	

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<p>-variety of interests contribute to overloaded feeling                      -desire/need of support structure tends to conflict with time demands of engr courses.                      -lack of confidence seems to negatively impact the women’s desire to participate in study groups – even though study groups would appear to be more female oriented.</p>	<p>-Grading in courses generally is tough. Averages may be 60% and that might get you a B.                      -To women this lack of perfection tends to lead to feelings of lack of confidence.</p>	
<p>-frustration if broader interests and perspectives are not valued in design courses                      -lower confidence may hinder risk-taking in classes and peer group interactions</p>	<p>Experience could be structured to improve confidence or extract participation in non-threatening ways.</p>	
<p>If they feel women don’t go with engineering, then they may feel they are not perform well in the major (gender schemas)</p> <p>Women also prefer to use engineering for the “common good or humankind” in comparison to what men desire to do with their major</p>	<p>Over time, they might leave engineering for another field or go into engineering education.</p>	<p>40% F</p>
<p>Oftentimes undergraduates women engineering students have varied interests. This sometimes affects their undergraduate experience in negative ways because they do not know how to prioritize their many interests and therefore do not balance their time well which leads to stress.</p>	<p>If they have a negative experience, their confidence levels go down, their perspectives are lowered and they have a lack of interests in participating in activities. The opposite happens (I believe) if they have good experiences.</p>	
<p>-selection of research or project teams                      -motivation to pursue prof. and/or leadership development opps                      -pursuit of opportunities to connect eng with service or addressing social needs.                      -if confidence level is low, it may lead to increased feelings of being an imposter – DO I belong here? Can I do this?</p>	<p>-positive experiences reinforce confidence and participation                      -Neg experiences, negatively impact persistence and retention                      -Access to increased resources may enrich perspectives and build confidence</p>	

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Lower confidence and lack of interest because of lack of relevant applications will affect retention rates. They are not commended for their strengths. Their perspectives are undervalued.	May influence the kind of work they pursue. Positive, reinforcing experience will enhance confidence.	
Lack of confidence inhibits participation	Leadership and outreach participation work to reinforce interests and confidence.	
If females were more involved in informal activities, it is imp to provide earlier activities that capture interests and are engineering related	If they are not successful in math and science, provide experiences that would encourage positive experiences that will nurture interest.	
Less prof. organ. Active part. –will need to design better recruitment -> more inclusive org.	Increase team work -> highlighting outcomes (team) and approaches/contributions (indiv.) Train faculty to use team work to build confidence.	
Confidence permeates everything. At age 53, I still have confidence issues!!	It only takes one or two confidence abusing experience to rain a woman for her entire career. These negative imprints can be seared into a memory for life, esp. if the abuser is a position of power.	
Women's interest may affect on what kind of engineering education they like	Their experience (positive) will affect on their confidence and finding job that is more demanding.	
Lack of confidence in abilities results in less volunteering (to speak in classes, provide insight/thoughts)= less public speaking in general		
	Playground data seem to suggest that they lose some interest in social issues from Year 1 to Year 4	
-low confidence can adversely impact experience. -being able to apply engineering concepts positively impacts experience. -interests have wide appeal on the self selected experiences	-positive experience in specific areas can mold interests -neg. experience will lower confidence -Neg experiences will either increase their advocacy of young women pursuing the field or make them withdraw from the field	

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-women are typically taught (modeled) to be caregivers, peacemakers, considerate of other (including animals and environment) and so are apt to consider others/other factors in the design process.	Because of the above, women may have trouble making design decisions that are satisfactory (perfect?) to all	
Confidence issues may mean females take fewer leadership roles in projects	Confidence can be developed by roles in experiences esp for leadership in projects	
Limit their participation in classes, activities etc. Place more stress on them in regards to balancing their interests and their coursework	Awards and recognition will propel them to greater success. Negative interactions with peers and faculty will lead [them] to spend more time on other interests and reduce confidence in field	
-knowing women have broad interests it is important to offer a variety of experiences and exposure to areas of engineering -acknowledge confidence issues and add confidence, leadership development to educational experience. -if interests are not taken into account -> they won't stay in majors.	They will come to Engineering with predisposed ideas that might not be grounded in reality.	
Don't take leadership roles in teams. Provide more of a nurturing role. Give up in tough courses. Set expectations that are too high.	More interested in finding solutions to human problems	
Avoid situations involving anything they are not familiar with – confidence. Lead them to majors that match their interests directly – ie BME, “help people.”	Success -> confidence. Exposure -> broadens interests and perspectives.	
Greater consideration and interest in of a broad spectrum of design experiences could lead to frustration with existing curriculum. Their lower levels of confidence (and tendency to internalize) would lead to lower levels of satisfaction with engineering education.	Experiences that do not address women’s full range of concerns and interest lead to frustration and lower levels of confidence that they “belong.”	



Question #1: How might women’s interests, perspectives, and confidence affect their experiences as engineering undergraduates?

Question #2: Conversely, how might their experiences affect their interests, perspectives, and confidence?

Response #1	Response #2	Other remarks
Have you considered factors such as cultural and racial demographics? This definitely influences interests, perspectives and confidence.	As mentioned, the dynamics of race, cultural experiences does influence perspectives.	
Very much so. Women need to be welcomed and embraced through encouragement.	Very much so. If a woman or any individual does feel if they are important or have something valuable to offer to the engineering profession, it will have a negative impact on their confidence.	
Add in the social science.  Social expectations of women are different than men. Not only are they orienting themselves to the education as a student but also to the “acceptance” that they may belong, be qualified and have/offer contribution.  Women have a stronger need to receive or to feel affirmation. IF men do, they are less likely socially to admit or ask.	Experience builds the confidence (its affirmation), broadens perspective and builds the interest. Now they’ll spend less time questioning themselves, proving themselves, now they transition to “being” the engineer/scientist.	
Bringing in research about male/female brain structure, function and chemical makeup may help frame some of these differences. Also, gender communication theory. Women’s brains (~60%) – both sides open up when concentration, one side of male closes when concentrating. Women tend to over communicate, express feelings, etc.  Women “mask” and are socialized to not show lack of confidence.	Because of the (60%) gender specific orientation and socialization, women will more likely pick things that affect people/make the world a better place, creating relationships, asking questions and “keeping the peace”/conflict adverse. So they will more likely gravitate to experience that relate to those issues.	
Participation in team projects (deferring to others) Choosing field within engineering Bring difference perspectives to design projects and discussions	Retention GPA Recruiting other women	
Senior design projects can provide the final experience that reflects their interests and perspectives.	Leadership opportunities in SWE, B3SS, SHPE, IEEE, ASME etc. can increase all three (interests, perspectives, confidence).	

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Response #1	Response #2	Other remarks
<p>-Leads to higher retention                      -Ability to serve as mentors or positive role models for younger students.                      -Support systems: Learning communities are proven to increase retention and often lead to higher GPAs than non-learning community students. Provides a sense of community.</p>	<p>Again-classroom experiences affect retention                      Support systems are essential</p>	
<p>Women appear to desire a broader range of extracurricular experiences as undergrads. This may improve the quality of their work as professional engineers but creates stress in balancing undergrad work with external interests.</p>		
<p>-how much confidence a student has in themselves directly/proportionally affects their experience. Once confidence is shattered they will not perform as well as an engineer (emotions start to play in).                      -however, women push harder to prove they can compete in a male engineering world.</p>	<p>-experience can lead to vastly different interest; women seem to need other activities that are not technical to keep them sane.                      -if bad experiences in engineering, they may pursue non-engineer careers (regardless of technical degree and need in industry) -&gt; happiness is most important.</p>	
<p>See increase numbers of biomed and environmental programs</p>	<p>Experiences -&gt; the importance of community building.</p> <p>Do you want my life story? ☺                      So many female students find the spark they need to get them on a professional path based on their experiences as undergrads. Running outreach programs kept me in engineering. Winning 13 year old girls over gave me confidence to speak to faculty and industry (teenagers are WAY scarier). Studying engineering has completely shaped my perspective on how the world works.</p>	

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Question #2: Conversely, how might their experiences affect their interests, perspectives, and confidence?

Response #1	Response #2	Other remarks
<p>As the students’ confidence levels rise, they become more active in mixed gender engineering group activities.</p> <p>They express differences in experiences with WIE activities then other group activities.</p>	<p>In our Intro to Engineering (can experimental class) female students participating in something like a Lego Robotics module may shy away from activities that they have not experienced before (like the building or programming). They then get “assigned” the tasks in their group to research or report writing.</p>	
<p>If women think more broadly than men do (in the design project ideas that you reference) shouldn’t that influence how design projects and concepts are taught? What if the concepts we teach are too narrowly focused? Does this disengage the female students?</p>	<p>Perhaps the process of how we focus our curriculum turns away females (who think broadly) by reinforcing that these broad concepts are less important (because they are not emphasized in the curriculum).</p>	
<p>If the engineering education experiences do not include or consider women’s interests, confidence and perspectives they may become disenfranchised; feel they don’t belong in that educational program and may leave.</p> <ul style="list-style-type: none"> <li>-subject matter relevancy</li> <li>-methods of teaching</li> <li>-opportunities for interaction</li> </ul>	<p>Negative experiences = decreased interest, confidence and narrow perspectives.</p> <p>Positive and varied experiences = broadened interests, greater confidence and possibly unique perspectives.</p>	
<p>Facing the issues brought about by family, education and gender issues, women might tend to lower their confidence and to face education and work world perceiving that they can achieve much less, then ending up with less satisfaction.</p>	<p>Negative experiences can create a negative vicious loop that lower confidence and perspectives. As educators we must take special care into ensuring that women can have positive experiences but also we must educate young male students be bridging the gap and facilitating their female peers.</p>	

Question #1: How might women’s interests, perspectives, and confidence affect their experiences as engineering undergraduates?

Question #2: Conversely, how might their experiences affect their interests, perspectives, and confidence?

Response #1	Response #2	Other remarks
<p>Women’s interests, perspectives and confidence affect their experience as engineering undergraduates, by increasing feelings of being overwhelmed, women feel dissatisfied with their quality of life because they are not able to effectively balance all the elements of their life that make them feel complete. This “seed” of dissatisfaction then grows, causing women to rapidly fall out of the pipeline at all levels.</p>	<p>More positive experiences will enhance confidence, as well as overall perspectives regarding engineering fields and careers, possibly encouraging women to “stick with it.”</p>	
<p>They may look at design from a female perspective. ie machinery designed for a man’s body type. Family life Service opportunities – more concerned with how a project will make a difference in society.</p>	<p>Women tend to dwell on failure or mistakes more. If they have trouble in one engineering class, they may be more likely to switch out of engineering.</p>	
<p>If they are more active in organization, their grades may be lower (I know several women students who have made this choice and are ok with trading lower grades for service opportunities).</p>	<p>Becoming active and interested in engineering service, allows women to investigate new or alternative career opportunities – ie more confidence, more diverse interests, more exposure to different perspectives.</p>	
<p>Women will interpret their experience differently depending on their confidence level. For example, if they have less confidence, they may attribute success on a project to external sources rather than their own skills and abilities. Also, women may judge their success or level of success on a different scale depending on confidence -&gt; ie, they may think their achievement is lower if they have lower confidence.</p>	<ul style="list-style-type: none"> <li>* We can use experiences of design to reinforce and strengthen interests; challenge and develop perspective and develop confidence.</li> <li>* Participation in activities beyond eng. May provide community necessary to persistence.</li> </ul>	

Question #1: How might women’s interests, perspectives, and confidence affect their experiences as engineering undergraduates?

Question #2: Conversely, how might their experiences affect their interests, perspectives, and confidence?

Response #1	Response #2	Other remarks
4.0 plan (Donna O. Johnson) – good learning system can help women (and men) get “control” if their crowded schedule.	Need to help women get a perspective on getting a “B.” Had all A’s; get a B, figure they need to change majors (out of engr.) The encouragement of a faculty member to a woman student that they are good and should go on FIT to graduate school (engr.) contributes a big difference.	
They will bring perspectives to projects and class discussion that will add diversity to the outcome.	They may give up. They may not fully participate.	
-willingness to take certain courses, engage in cooperative work experiences -selection of course work and an engineering major -might focus on outside/extracurricular activities	-support or challenge their beliefs -mentors/role models can have positive impacts	
(how does it) affect the academic and career goals they set – how “high” (academic -> grad school or not? Masters vs. PhD) (industry -> management?)	WIE programs may serve as mechanisms (via social support) for women to develop confidence	
They may take part in more leadership and career development activities as seniors		
I’m interested in women’s consideration of more factors and how it (and more social and extracurricular activity) contributes to overload. It is an often-cited reason for leaving engineering. I think it would be interesting to explore confidence as a constraint to a person’s ability to think aggressively/creatively about new ideas	I see all these things as intertwined, and affecting each other. I worry about how 18-22 year olds make decisions about life choices; and know from personal experience that sometimes small insignificant things are the foundation for their choices.	
-increase likelihood of dropping out (lack of confidence) more likely to -interpret experiences negatively (feel less qualified and use that as a lens through which they filter their experiences and react to them).	-success and positive feedback can increase confidence, interest (passion) -negative experiences decrease interest, confidence (even 1 negative mixed in with many positives)	

Question #1: How might women's interests, perspectives, and confidence affect their experiences as engineering undergraduates?

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Response #1	Response #2	Other remarks
<ul style="list-style-type: none"><li>-provides the foundation for learning</li><li>-these are attributes that university, faculty and the engineering environment do not support or nurture</li><li>-the more self aware a person is about their interests, perspectives and confidence level, the more understanding and accepting of difference they are and may have better experiences</li></ul>	<ul style="list-style-type: none"><li>-if curricula, faculty and the engineering environment are based in historical norms, women's experiences will be less satisfying</li></ul>	