Teaching Adult Engineering Learners – Ease and Challenges

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Abstract – In this paper, the faculty and student perspectives of the challenges faced by adult students are highlighted. Data is collected through various interviews. It is observed that adult students may experience certain challenges e.g. being out of touch with technology and feeling isolated from other students in class. Despite these challenges, adult students bring experiential knowledge into the classroom, which can add tremendous value to the educational experience for all students, if the faculty members are open to leveraging that knowledge. The overall objective of this study is to make faculty members aware of the needs of adult students, acknowledge and appreciate the students' presence and their contributions in the classroom.

Keywords: Adult Learners, Learning Styles, Teaching Strategies, Non-traditional Students, Adult Students

INTRODUCTION

Adult learners are referred to as non-traditional students who are returning to school to earn their education at an older age. These students are typically not in the 18-21 year age group and have work and life experiences. Due to lack of experience with technology, non-traditional students may feel intimidated when returning to college. They are usually in the minority when surrounded by younger students. In some cases, they may also have a professor that is younger in age. This creates an awkward position for the non-traditional student (and the professor). These adult students may bring to class much knowledge about the subject matter or they may have forgotten the pre-requisite material. Having worked in their field, they may have a difficult time relating classroom theory to the practical applications.

In this paper, the authors explore challenges faced by the adult students; highlight what faculty can do to accommodate their adult students; and review, through a series of interviews, how faculty members make their adult students comfortable in their classes.

Berk [1] indicates that 40% of North American college students are over age 25 and 60% of these students are women. The reasons for returning to school later in life are diverse. The changes may include:

- Job change
- Desire for better income or promotion
- Life transition
- Personal achievement
- Self-enrichment

Adult students may face outside stresses including those from work, children or family, traffic, etc. which may lead to limited time devoted to studying. An adult student may be faced with a question as to whether to spend ten hours studying to earn an 'A' or spend five hours to earn a 'B'. Traditional students do not necessarily face these same challenges. Adult students understand the value of education and realize how it will benefit them in the work force

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and in their fields. Adult students return to school because they want to earn the college degree as opposed to the traditional students, who may not fully appreciate the value of a college education. Because of this difference, adult students usually want to be in the classroom. However, faculty members either do not know how to deal with adult learners or find it challenging. Adult students may have attitude (either positive or negative) regarding previous classroom experience. They also exhibit aging factors that affect learning. All of these factors may affect their college performance. In this study, two sets of surveys are conducted. In the first survey, faculty members who teach adult students are interviewed. In the second survey, adult students are interviewed. The set of questions and faculty and student responses are summarized in the following sections. The overall goal of this study is to make faculty members aware of the presence of adult students in their classes, address their needs, and acknowledge their prior learning experiences.

ADULT VERSUS TRADITIONAL STUDENT

Adult students exhibit characteristics that are different from the traditional students. Adult students are problem centered – they seek educational solutions to where they want to be in life. Youthful students are subject oriented – they seek to successfully complete each course regardless of how course relates to their own goals [2]. Adult students are result oriented – they have specific results in mind for education. They may drop out if education does not lead to those results because their participation is usually voluntary. Youthful students are future oriented – youth education is a mandatory or an expected activity in a youth's life and is designed for the youth's future. Adult students are self-directed – they are typically not dependent on others for direction. Youthful students depend on adults for direction. Adult students are skeptical about new information and prefer to apply the information before accepting it. Traditional students are likely to accept new information without trying it out or seriously questioning it. Adult students seek education that relates directly to their perceived needs. They want to know why they need to take courses not felt relevant to their degree. Youthful students seek education that prepares them for an unclear future. They accept postponed application of what is being learned. Adult students accept responsibility for their own learning if learning is perceived as timely and appropriate. Youthful learners depend on others to design their learning and are reluctant to accept responsibility for their own learning. These differences are summarized in Table 1.

Table 1: Characteristic differences between adult and traditional students

Adult Learners	*Youthful Learners*
Problem-centered	Subject-centered
Results-oriented	Future-oriented
Self-directed	Dependent for direction
Skeptical about new information	Accepting of new information
Seek work applicable education	Accept postponed application of knowledge
Accept responsibility for learning	Depend on others to design their learning, reluctant to accept responsibility

Faculty Perspectives

Faculty members are interviewed in this study. Faculty members represented in the interviews include professors from management, electrical engineering, industrial engineering technology, and languages. The interview questions and their corresponding answers are listed as follows. The authors believe that the answers are applicable across disciplines and therefore the answers are not separated based on the discipline of the interviewees.

1. *How do you deal with adult students in your classroom? What are some of the considerations faculty need to keep in mind while teaching adult students?*

It is noted that adult students almost always have other obligations besides going to school. These obligations include family responsibilities, travel requirements, jobs, etc. Faculty members treat adult students as working

professionals and are in a working environment when they are in class. To a certain extent, the faculty members act as a supervisor and more importantly as a mentor.

Faculty members try not to treat adult learners differently than the traditional learners because they feel that the material is equal for all the students. Information is presented but it helps for the professor to be flexible to the needs of adult students in regards to the background or pre-requisite information needed or the depth at which certain material needs to be covered. Adult students ask questions that pertain to real life situations. They try to connect the theory with real world experiences and try to find connections from their experiences as to where that knowledge could be applied. A faculty member can relate a story of a personal experience or ask the students if they have any relevant information to share. Adult students usually have a well-defined purpose in mind. They are serious about being at school especially because they have made financial and time investments and have to fit in the school in their schedule.

One professor states that there are two types of adult students: the student that appears arrogant and the student who thinks he does not know anything. The arrogant student should be encouraged to share his knowledge and the second student needs confidence to be willing to discuss his experiences. All students need to be given a chance to shine, to share their feelings and be heard. There are students that have much technical experience and all students will benefit when these experiences are shared with the class.

2. *What do you differently when teaching an adult student verses a traditional student?*

Faculty members mention that they do not do anything extra ordinarily different when teaching adult students. All students must have satisfied the pre-requisite courses for any engineering course. Students can be encouraged to review the mathematics book and refresh their knowledge. They can also be referred to tutoring resources on-campus and online. The recognition of the fact that there are adult students in the class and that they might have special needs may settle well with all the students. Faculty members can also leverage the experiential knowledge that adult students bring to their classroom because of their background. This knowledge is more valuable than the theoretical knowledge and other students may retain it for a longer period.

It is noted that learning styles are different between adult and youth learners because adults are more self-guided in their learning. They bring more, and expect to bring more, to a learning situation because of their wider experiences. Similarly, they can take more away. They require learning to 'make sense.' They will question the efficacy and might not perform a learning activity just because the instructor said to do it.

Decker argues that although there are multiple types of motivations, there are two main types: intrinsic and extrinsic [3]. Extrinsic motivation refers to motivation from an outside source, for example money. Intrinsic motivation is motivation that is inherent to an activity which one performs. Intrinsic motivation results from no external reward. Keller's suggests motivation design based on Attention, Relevance, Confidence, and Satisfaction (ARCS) [4]. Keller's ARCS motivational design supplements the learning process with motivation.

- *Attention*: Course contents and the instructor needs to 'hook' the student's attention. Course design should be creative and sustain attention.

- *Relevance*: Course material should be relevant. Adults want to know why the material is important and how they can apply the material in their own lives. Real-world examples are typically beneficial in helping Adult Students see the relevance.

- *Confidence*: Students need to feel confident in their abilities to succeed. Instructors should encourage students and help them become successful

- *Satisfaction*: Students must experience satisfaction with the process of learning. Extrinsic and intrinsic motivators are beneficial at this stage.

Adult students need to know how a given class will meet their needs. Faculty can ask students why they are enrolled in the course. How do they learn best (aural; visual; hands-on)? How will they apply to their job what they have learned in a given class? Faculty should take into account the learning goals for their course and backgrounds and learning preferences for adult students.

Talking to students at a level where they feel comfortable and at the same time establishing the authority is a delicate balance that many professors need to establish. A professor needs to be clear, have a good command of the subject matter and have well defined expectations. One professor reports that she evaluated a student's writing and

the student felt that she did not correct it properly. The professor referenced the rubric and highlighted areas where the writing could have been improved. At times, when the students complained that they deserved a better grade than what they received, the professor would re-evaluate the work and provide students with an extra credit opportunity to enhance the grade. It is important to clarify the philosophy of teaching. If makeup exams and quizzes are not acceptable, and extra credit assignments are not available, then that should be clearly outlined in the syllabus and repeated in the class. If the students make a mistake, they should have plenty of time to recover. There should be multiple ways for students to earn credit.

Young professors have less experience than older students in the classroom. These older students do not necessarily need to be lectured. They already have the knowledge. These students could be used as helping hands. They could be used to share the class load and even help teach the class. Adult students can contribute in different ways. They can encourage traditional students. Some students may get irritable because they come to the class thinking that they know everything and do not see the value of being in that class. Some professors suggest policies such as credit by examination where students can receive credit for the class without having to go through the full fifteen week semester.

One professor in the British Literature class asks students to write about the social class to which they belong and to write about someone who is in a different social class. Students names are randomly chosen from an 'envelop of opportunity' which has the names of all the enrolled students written on little slips. The student whose name is chosen reads his response to the class. This gives all students a chance to discuss about social classes and personal experiences without being pressured. It is observed that since adult students have read and seen more than traditional students, they bring a wealth of information into the classroom. They know more about subject matter than traditional students. Giving adult students a chance to show their knowledge is valued by them.

3. *What examples can you share with your students to ensure they see relevance in the material you are teaching?*

Faculty can help students by showing how new knowledge or skills can be applied to current problems or situations. They can use participatory techniques such as case studies and problem-solving groups and relate new knowledge to previously learned knowledge. Faculty should focus on theories and concepts within the context of their applications to relevant problems. They can orient the course content toward direct applications rather than toward theory.

In an English literature class, students choose a topic to write and usually share information about their work experiences. In another assignment, they are asked to write about an area of expertise they have that most of the other students in the class may not possess. This knowledge is then shared amongst students and benefits all students.

Faculty members may have students write a biography about themselves and their work experiences. This information can then be used for classroom sharing and forming groups. Adults will benefit from being accepted as part of the traditional classroom amongst traditional students.

In one engineering economy class, an adult student mentioned that he did not see the value of the theory and asked where all the notations discussed in the class applied in the real world. In this conversation, the professor found out that the student was a manager in an organization. The professor explained to the student that as a manager, the student probably dealt with different projects with different arrays of funds going in and out. If the student wanted to compare various projects and decide which project to select, they would have to pick one number for each project that could be used for comparison purposes. Because the explanation was directly related, the student was able to understand how the mathematics made sense and now he could appreciate the value of the theory and in-class work. Faculty can help adult students by establishing some kind of relation of the theory to what students know. Sharing a story like this to future students might also help other students realize the importance of the subject.

4. *What are some activities you do to engage adult students?*

The presence of adult students in a classroom opens doors for a wealth of knowledge. Faculty could utilize this knowledge as resources for themselves and for other students. Faculty members can use open-ended questions to draw out students' knowledge and experiences. This provides many opportunities for dialogue among students. These discussions may also be considered a graded in-class activity and it is important for students to know that their engagement is expected during these in-class discussions. It is essential that the professor take time to clarify student expectations for the course and a grading rubric should be provided by the professor at the beginning of the semester detailing deadlines, requirements and expectations. Student performance is better when they are engaged. A comfortable teaching environment that permits debate and challenges ideas should be established. Questions and comments need to be treated with respect. Professors should be careful to protect minority opinions within the class and acknowledge all student contributions but faculty should not expect students to necessarily agree with the professor's opinion or plan for the course.

Faculty could engage students in designing the learning process; expect that students' desire more than one medium for learning and want control over their learning pace and start/stop times. Adult students need less hand holding and support than traditional students. They also need fewer reminders of due dates. A well planned calendar of events and due dates is all that is necessary for them to understand the expectations and complete the work. Some programs have bridge courses that help ease students into the main courses. This helps with adult student retention [6].

Field trips are great educational experiences and working adult students have contacts at industries. Faculty could utilize these contacts to arrange for field trips. Students are encouraged and are motivated to learn when they return to the classroom after the field trip. Other long and short term benefits of field trips have been studied extensively [5]. A professor may have a few contacts but by leveraging the contacts of adult students who work at the related industry, they can facilitate the trip and coordinate the logistics.

Working portfolios are another engaging activity: students work for a real client or a non-profit organization that needs the support that adult students provide. Efforts of adult students not only help build a strong portfolio but also help the clients who will likely use what the student produced. Students report in their evaluations that they worked even harder because they knew it was a real project.

Faculty members can use discussions and online discussion boards. To encourage discussion board postings, one professor assigns a grade to these postings. In the discussions, students learn about each other. Leaders are assigned for each discussion. The leader, an adult student, posts a few questions based on the reading and the support materials that will engage fellow students in a lively discussion. The leader is responsible for keeping the discussion going throughout the week. The leaders check-in and respond to what other students have said. The professor can step back and observe the discussion. She also provides comments to lead the direction of the discussion; encourage ideas, and observe learning. Students are involved in this activity by bringing in work experiences, sharing something related, or that happened on the job, etc. This reminds other students of their own experiences that they can share. These discussions are invaluable for students who might not have any experience in the field. The discussions help build relationships between students during the semester. It has been observed that they help each other network, find jobs, and share information learned. The relationships help them form teams, during the course, in the follow-on courses and even in jobs after graduation.

In engineering there are laboratory experiments that help engage students. Design projects help stimulate students. In the introductory courses, students hear the professors say that there are different learning styles e.g. kinesthetic learning, visual learning, oral learning but by demonstrating these helps students understand which one of those learning styles they prefer. An example shared by one professor is that of soldering exercise. Soldering is the process of melting different alloys to create a semi-permanent bond, which is then used in printed circuit boards. First the students are taught the theory of soldering. Some students will learn and retain that information. Students are then shown a video of the proper technique of how to solder. The visual learners see and learn it. The final step is to go to the laboratory and do the soldering. It is observed that a large number of engineering students are kinesthetic learners where they learn by doing. It would be beneficial if professors continue to explore other ways of learning and help students identify their individual learning styles.

Dawley describes the benefits of small groups [7]. Her research indicates that students who work together learn more than students who work alone. Dawley states that "Social interaction is positively related to information retained by students."

Kenrick et. al. suggest that active group participants [8]:

1) Make individual contributions identifiable.
2) Make the task meaningful to members.
3) Ensure that group members know that a successful project includes contributions from all members.
4) Increase group cohesion (e.g. allow friends to form a group.)

In a group project, the instructor can collect information from students to help in assigning groups. Group leaders may also be assigned or elected by group mates. Adult students take the responsibility of group leaders. The instructor should set guidelines and provide ways in which group members may communicate. Students will need to be able to meet virtually and share their documents. Professors should check in with the groups. It is recommended to assign responsibility for students to assess themselves and their group mates. Faculty can provide students with a rubric allowing them to indicate their individual contributions and the grade they deserve with an area to describe contributions from their group members and their recommended grades. This may provide the teacher with important information when grading the projects.

In certain classes students are randomly divided into teams. In groups, adult students typically take control. They are organized. They know what needs to be done and when it is due so they get the rest of the group engaged. They would divide part of the work amongst the team members. This leadership helps other team members.

5. *Adult students either come to class with a lot of background information or forget the pre-requisite material because they have been out of classroom for a long time. How do faculty members deal with these issues?*

Adult students may have forgotten pre-requisite material when they arrive in an upper level class. Those students who may have forgotten this material should be encouraged to retake pre-requisite courses or attend tutoring sessions. The professor may spend some time on review but too much time on previously learned material. Tutoring groups can be arranged where students can tutor other students. Students find that when they teach someone, it re-establishes the concepts for them as well. Special office hours or designated times could be setup for students to meet with the professor on a one to one basis.

One professor indicates that they have had instances where particular students wanted to be the leader of the class. This professor would accommodate these students' questions; letting them share their expertise and even give them homework to research material where they could lead a discussion.

Students who possess the attitude of knowing much course content can be used to help teach the class. Professors, who should also be open to learning from their adult students, need to recognize which students know the material and provide these students with a platform to share their knowledge. Be encouraging to students, especially female and minority students, who have much experience but believe they might not have enough to share their experiences. Professors can help these students realize the wealth of information that they have and make them feel more self-confident when in class. During open office hours, these students should be encouraged to meet with their professors on one to one basis.

6. *How is teaching adult students online different from teaching them on campus? What can faculty do to help adult students succeed when taking an online course?*

Adult students enroll in online courses because of the flexible opportunities these classes offer. Despite these advantages, online classes may initially be intimidating to adult students who may not have had as much experience with technology as the traditional undergraduate students. Faculty experiences indicate that adult learners perform better in the online environment than traditional students because adult students understand the value of an education and are highly motivated. Adult students are usually working within their profession which may not be the case for undergraduate students. Online classes aide the adult learners with their busy schedules and they are able to take the class when their schedules permit.

For adult students, it is a good idea to teach an introductory bridge course to orient students to the online environment. Professors can aide online students by maintaining weekly online office hours. It might also help to provide a weekly modular summary by posting key points and feedback to the class. Unengaged students can be prompted via email. Students who need extra help can be offered a study guide containing lists of questions or practice problems for exams. Adult students who may not be technology savvy can be paired up with a younger student. In an online environment, student success can be ensured by establishing weekly communication between the professor and the students. Since online learning is a team environment, all students need to be active participants and must have a sense of self-discipline to maintain active engagement throughout the course. Similar to the work atmosphere, online courses have due dates which need to be met. Prompt feedback is one key requirement: faculty should emphasize deadlines but should also exercise flexibility when warranted. They should set high expectations and respect diverse talents and learning styles [9].

Online courses may be personalized by providing a picture and video or voice recorded message to the students. Faculty can use the announcement area to send a welcome message during the first week of the course. This is also a great place to give encouraging remarks to students in general and adult students in particular.

It is recommended for faculty members to stay connected with their students through email. Students expect a response within 48 hours. Because of their work experience, adult students see emails as the formal mode of communication. Emails can be imported into cell-phones for quicker communication and feedback. Faculty members use social media and dedicate a page to their course and students. This is a great place for the students to connect and share more personal and fun information. Likewise, faculty members use weekly discussion posts. This could be an important area to exchange information. Once started, professors need to be active participants in this area; guiding and directing their students to expand their thoughts. Some of the other strategies include the use of chat rooms, live learning management collaborative rooms, Skype, Google chat, document sharing, etc.

Many professors enjoy face-to-face interactions when teaching in the classroom but because of the market demand, they teach online or in a hybrid format. It is observed that if a course is available both online and on-campus, most of the students enroll in the convenient, online course. The online students are encouraged to make appointments and visit the faculty members during the office hours but it is observed that most of them do not take advantage of this option. There are professors that use all tools available for online instruction: some of these tools include live classroom sessions, recordings, discussion boards, wikispaces and blogs, but they still miss the classroom interaction. It is an unfortunate fact that some faculty members personally meet their students for the first time during graduation ceremonies. It is expected that more and more students will switch to the online environment as they become more comfortable with this environment; enjoying the flexibility and freedom that online education affords them.

Online education, formerly called distance learning, has evolved. One does not need to be at a distance to enroll in an online course. Many universities offer hybrid classes where students switch as it fits their lifestyles between on-campus sessions and online sessions. The online and on-campus sessions are conducted at the same time. The same session is broadcasted online for students to participate asynchronously. These sessions are also archived for later viewing. Those students who cannot attend the live sessions may participate by attending it asynchronously.

Adult Student Perspectives

Following are some of the responses received from adult students during the interview process of this research. Only some of the responses resonate well with faculty members. Opening the doors of communication by both the faculty members and the students would be beneficial.

1. *What are some of the challenges that you face as an adult student?*

Adult students reported challenges of returning to school and earning a college degree. As there is no limit on the age of returning students, some of them report having memory issues and find it more difficult to retain information. Another challenge is finding a balance between family, which is a priority, and academics. Because of family and work commitments, education usually becomes of secondary importance. Adult students also have to dedicate a certain amount of time completing homework after working a full day. Adult learners still appreciate returning to

school and enjoy their experiences. They see their return as a new opportunity and a chance to achieve their goals. They feel that professors view them as adult learners and feel that they are expected to model leadership skills to the younger students. This becomes another responsibility for the adult students.

2. *Do you have any examples of any classes you have taken where faculty made arrangements to accommodate you as an adult student?*

Accommodations from faculty members make significant differences in an adult student's college and career experience. One student reported that she could not register for a constitutional law class because of a scheduling conflict. The course was offered at 2:30pm which was the time when her small children needed to be met at their bus stop and escorted home. She needed to be at the bus stop but, if she did not take the course that spring semester, she would have to wait until the following spring to take it, which would push back her graduation and delay her progress. The student explained her position to the professor and the department head. The professor suggested that she take the class by following along the posted schedule, complete the textbook readings, and submit weekly papers. The professor shared this student's assignments to the other students in class. The student thought that this approach worked well for her. She found it interesting that by the end of the semester, most of the students in the class knew who she was even though she had never met them. The student felt that she was allowed to be interactive in the class. She was able to participate and learned much because she was required to do introspective thinking. The student mentioned that this was an "awesome" experience and she really appreciated the accommodations made by the professor.

Adult students reported in the interviews that their needs are not often addressed. They feel that most of the university's facilities are made primarily for the younger, traditional student. Professors need to be aware of their adult students and try to accommodate their learning needs. Basic adjustments are all that are needed to make the students feel comfortable.

3. *What classroom activities helped you learn as an adult learner (visual, auditory, how faculty encouraged you to bring your knowledge to classroom to learn)?*

Adult students reported that they learn better in a lecture based class where they can freely ask questions. They do not prefer power point lectures where they are expected to absorb and regurgitate information. When teachers involve students in the discussion, students feel more connected to the subject material. The interviewees mentioned that having audio lectures are useful because the information may be reviewed during a commute. These working students found night classes were more suitable to their schedules.

4. *In addition to attending classes, what else would be helpful to help you learn better (lecture capture, review sessions for tests, sample papers or projects, sample model projects from previous sections of the course etc.?)*

Adult students reported that faculty podcasts, posted on the course websites, were very useful. Adult students especially value the archives because they can review and revisit the material at their leisure. This method of informational delivery aided in declining stress in the adult learners. Students expressed that they would be interested in spending extra money to have lectures on audio.

Adult students learn better when provided examples and models of the material. If the professor is introducing a new way to write citation for a paper, it helps to have a few examples of the required formatting style. Seeing the actual examples, models, and visuals help students make connections.

Some programs are offered online to accommodate adult students. There has been positive and negative feedback from students and faculty about online teaching [10]. While some students enjoy the flexibility, others choose not to enroll in online programs as these students enjoy the face-to-face interaction of the traditional classroom, engaging with other students and the professors. Some adult students even mentioned that they would not hire someone whose entire education was earned solely online – as they believe that part of the learning comes from becoming immersed in the experience.

Considerations for Faculty

Non-traditional students bring a good balance to the school. Inherent leaders, they offer knowledge from their own experiences. Although being an adult learner has its own stresses of balancing family, work, commute and homework, adult students may feel that there is an advantage to being non-traditional student.

Adult students enjoy college – it is their own decision to attend. They value the importance of contact time with the professors and other students. They also see the value of tuition and an education. By accommodating the adult students, faculty members can make the adult students welcomed. Based on the input from faculty who teach adult students, some ideas to aide the adult students are listed in Table 2.

Table 2: Ideas to Aide in Supporting Adult Students

Ideas
Provide upfront course expectations
Consider adult student's life and work experience
Make course contents relevant to adult experiences
Make course contents and learning objectives relevant to adult career goals
Permit adult students to work ahead to allow for their busy schedules
Provide assignment options
Provide support system for both face-to-face and online students

One professor reports that the largest difference between the adult learners and the traditional students is the flexibility that one needs to have with the adult learners. Flexibility can be offered by means of delivering course content material; collecting projects; and administering exams.

Conclusions

Through the interviews with professors and adult students, it is noted that faculty members do not have to teach adult learners very differently than traditional students. Using adult students to share their knowledge and experiences or deliver instruction in the classroom is beneficial. Professors can aide adult students in applying theory to real world applications. Faculty could create video or audio archives of lectures, pre-requisite material, and other online material to aide adult students. This content will reduce the professor's workload and the resources will be re-useable while also helping adult learners feel welcomed. These students will gain more from their college experience; most importantly, because of the adult students' presence, the entire class will become a richer learning environment for everyone.

Acknowledgements

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