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Bridging the Gap: Accelerating Engineering Management Education Through Innovative Graduate Pathways

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Abstract

The University of Arkansas (UARK) has introduced an innovative accelerated Master of Science in Engineering Management (MSEM) program, designed for undergraduate students in ABET-accredited engineering programs. This program allows eligible students to transfer up to twelve graduate credit hours into their undergraduate studies, facilitating a seamless transition to graduate education. A comprehensive survey was conducted among 68 junior-level engineering students to evaluate their preferences regarding the MSEM program, focusing on aspects such as program scope, cost, and time commitment. Results showed that 35% of students expressed interest in pursuing graduate studies, and students' primary concerns were related to flexibility in course delivery, which includes asynchronous online coursework. Most of the students expressed an interest in being able to complete the degree in one year or less and surprisingly expressed limited interest in graduate certificates or applying undergraduate credits to the master's degree. Students were concerned about cost, with less than half of respondents willing to fund their graduate education out-of-pocket. The findings suggest that programs like UARK's MSEM should emphasize flexibility, affordability, and clear communication of program benefits, while exploring financial aid and employer support options. This research provides valuable insights for universities seeking to design graduate programs that align with student expectations and career goals.

Background

The University of Arkansas (UARK) has launched an innovative accelerated Master of Science in Engineering Management (MSEM) program tailored for undergraduate students pursuing ABET-accredited degrees. This program enables eligible students to transfer up to twelve departmentally approved graduate credit hours of 5000-level courses into their undergraduate curriculum, facilitating a seamless transition to graduate studies. Offered fully online, it caters to graduating seniors entering the workforce full-time.

To ensure alignment with student needs, the authors conducted a comprehensive survey to capture the "voice of the customer." This survey utilized various question formats, including Likert scale responses, multiple-choice questions, and open-ended inquiries, to evaluate the factors influencing students' decisions to enroll in the accelerated MSEM program. Key areas of focus included program scope, cost, and time commitment.

The UARK MSEM offers a ten-course (30 credits) online master's degree in which classes are taught asynchronously online via Blackboard with a weekly live-online session with the instructor. The live-online session is optional and is recorded for students that cannot participate live to have the option to watch it later. Online classes with an optional live interactive session make it possible for online education to help overcome the common misconception that online learning is a solitary, self-paced, non-instructor led activity [1], and it retains the social and participation aspects that are a key factor in the success of online learning [2]. The 2010 meta-analysis performed by the U.S. Department of Education [3] found that, on average, students in online learning conditions performed modestly better than those receiving face-to-face

instruction. Moreover, using the live interaction instruction possible with Zoom and Blackboard Collaborate could help address the Sloan-C quality elements including learning and cost effectiveness and institutional commitment, access, faculty and student satisfaction [4].

Introduction

Although the successes and student opinions of online learning are well established, the fact that the students in the present study were all enrolled in the junior level industrial engineering class of Project Management and are providing their opinions about online graduate education in engineering management could illuminate a unique and specific perception. Thus, an eleven-question survey was constructed to improve the UARK MSEM program and was taken by sixty-eight engineering students to determine their preferences regarding engineering management online master's degrees and certificates.

Methods

During the sixteen-week fall 2024 semester, sixty-eight students in the junior level industrial engineering Project Management class completed the non-anonymous survey found in Figure 1. Three advisors for the MSEM program at UARK provided a presentation giving an overview of the MSEM program at the end a of Project Management lecture before the students were asked to take the survey. The questions only deal with their preferences regarding graduate school and not with the performance of the professor or student in class. Thus, there was no need to make it anonymous, and the students volunteered their names with the survey. The survey asked questions relating to the following aspects of program scope, cost, and time commitment as well as open-ended questions. The Likert scale questions are written in the affirmative, and the answers that strongly agree or agree with the statement are given a 1 or 2, respectively and answers that disagree or strongly disagree with the statement are 4 or 5, respectively. An answer of 3 means the student feels neutral and neither agrees nor disagrees with the statement.

Scope

1. After finishing my B.S. degree I plan to go to work full-time and NOT be a full-time graduate student.
   Yes or No
2. After finishing my B.S. degree I am interested in getting a master's degree online while working full-time.
   1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Disagree 5) Strongly Disagree
3. After finishing my B.S. degree I am interested in getting a master's degree in **engineering management online** from the University of Arkansas while working full-time.
   1)Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Disagree 5) Strongly Disagree
4. If I was going to work on a master's degree while working-full time, the flexibility to take classes online asynchronously (no set class time) is important to me.
   1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Disagree 5) Strongly Disagree
5. I would be interested in getting a certificate (four courses) in (PM, LSS,) if I could apply these courses toward a full master's degree (which is two more courses) if I decide to keep going.
   1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Disagree 5) Strongly Disagree

Time

6. I would be more interested in getting an engineering management master's degree online from the university of Arkansas **IF** I was able to apply four classes out of ten from undergrad and only needed to take six more classes.
   1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Disagree 5) Strongly Disagree

7. If I was going to work on an online master's degree, my desired completion time is _____ (MSEM offers two 8 week classes in fall and spring semesters and one 8 week class in the summer)
   a. Less than 12 months
   b. 12 months
   c. 18 months
   d. 24 months
   e. >24 months

Cost

8. I am willing to pay for graduate school ($313/credit for MSEM*) even if my current employer will not reimburse it.
   1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Disagree 5) Strongly Disagree

Comments

9. Please provide any detailed suggestions about how to customize online education that would make the difference in your deciding to enroll:

10. I would be willing to be contacted to give my opinion on any aspect of this survey or to obtain further information on the MSEM program: (Please provide: Name, email, phone number)

11. Please provide any other comments.

Figure 1: Survey given to UARK junior-level engineering students in Project Management class

Results

Sixty-eight students participated in the survey out of the seventy-six students in the class. Figures 2 through 9 below show pie graphs with percentages of response to the survey.

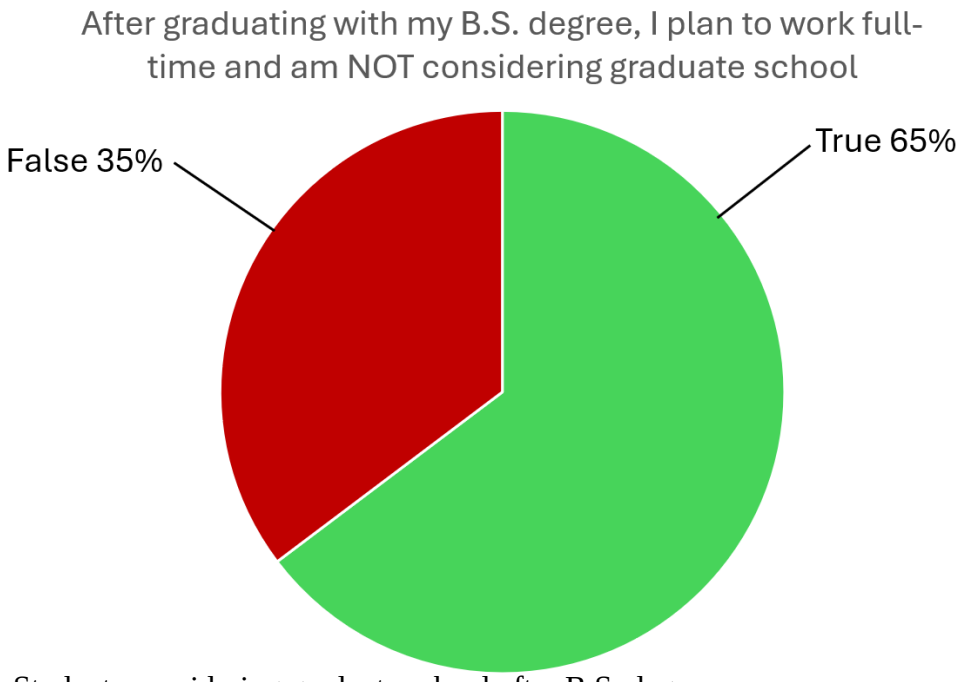

Figure 2: Students considering graduate school after B.S. degree

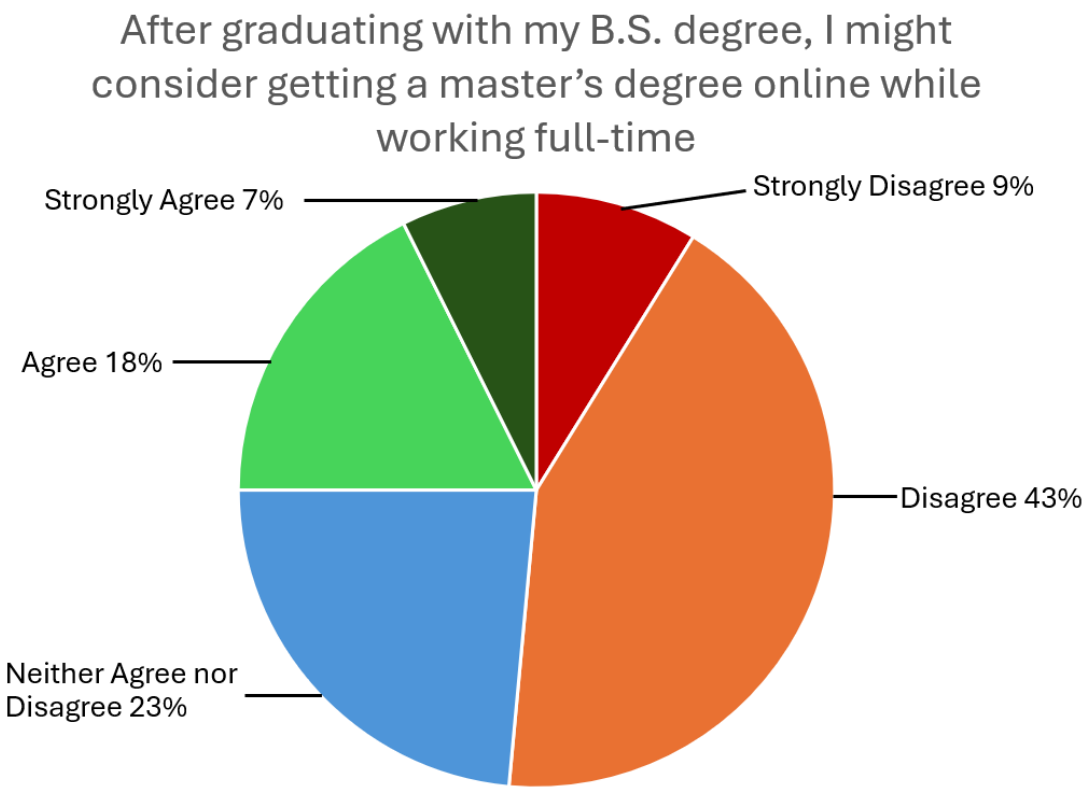

Figure 3: Students considering online graduate school while working

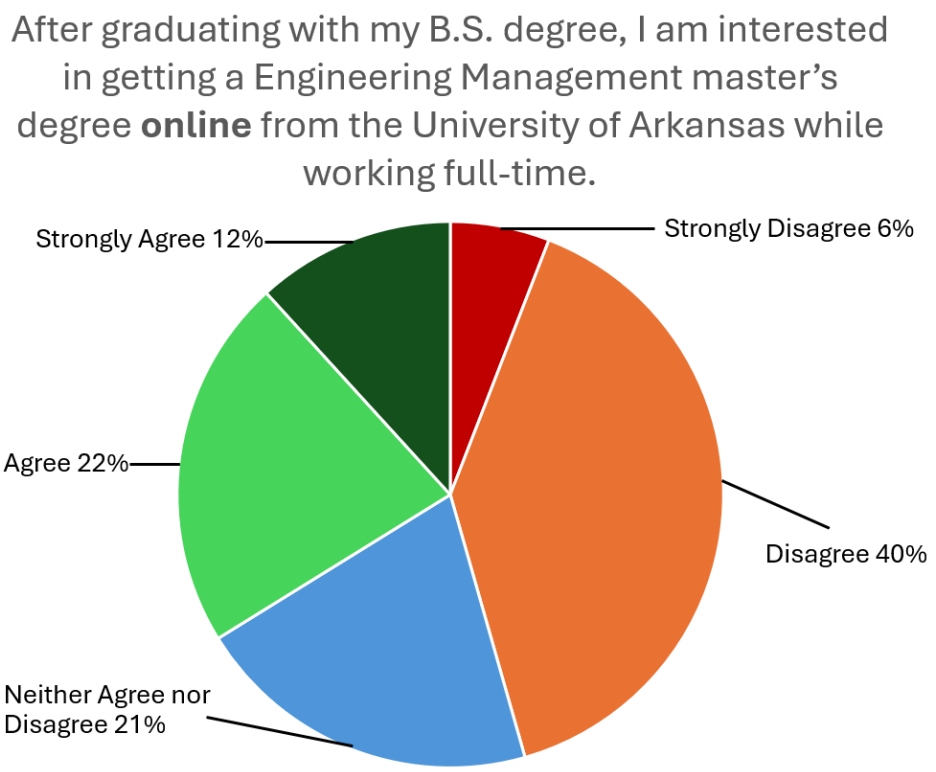

Figure 4: Students considering online MSEM at UARK while working

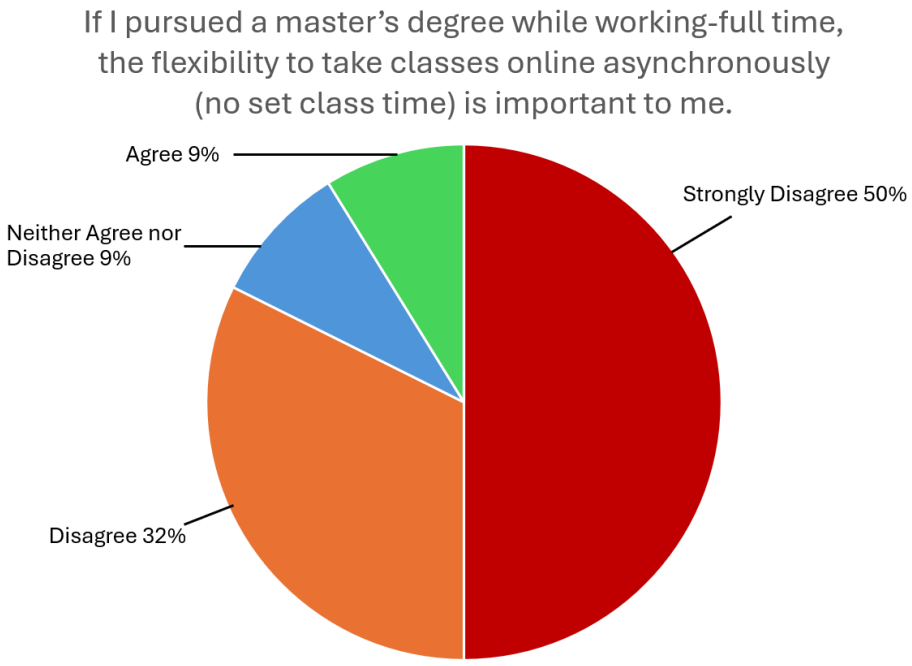

Figure 5: Importance of online, asynchronous classes to student

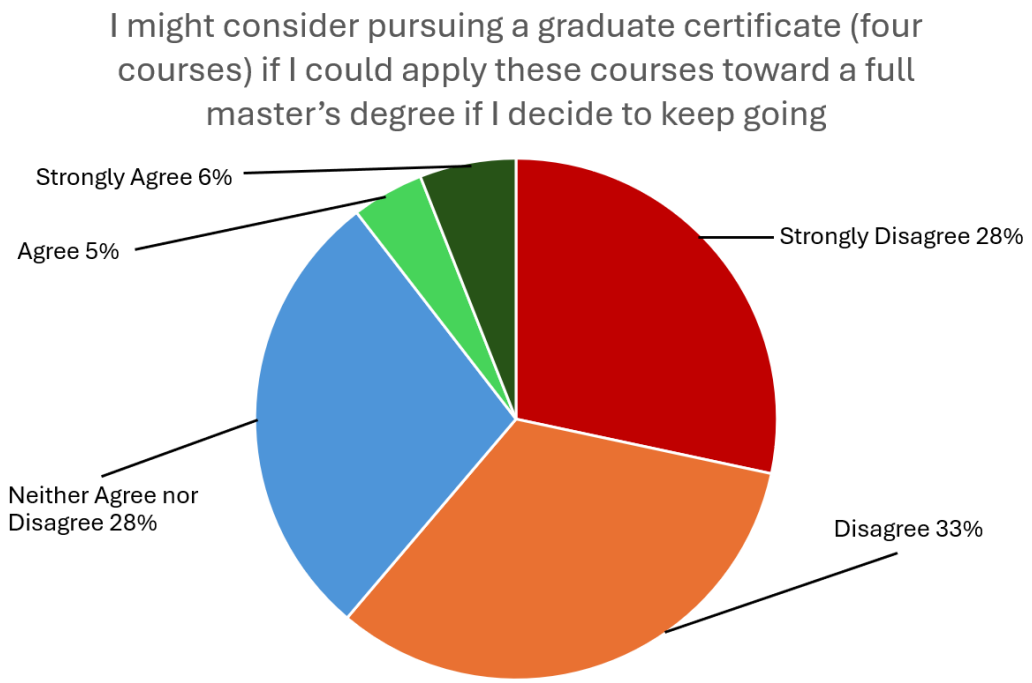

Figure 6: Impact of applying graduate certificate credits to full master's degree

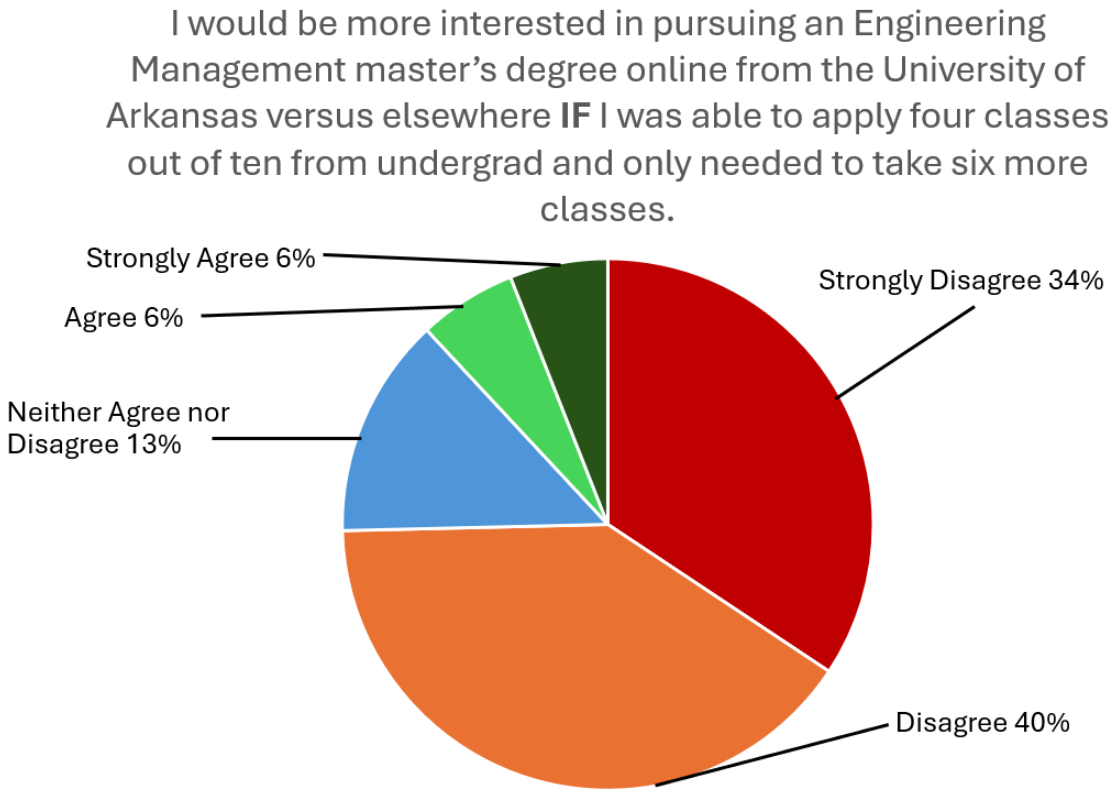

Figure 7: Impact of 4+1 program on staying at UARK for master's degree

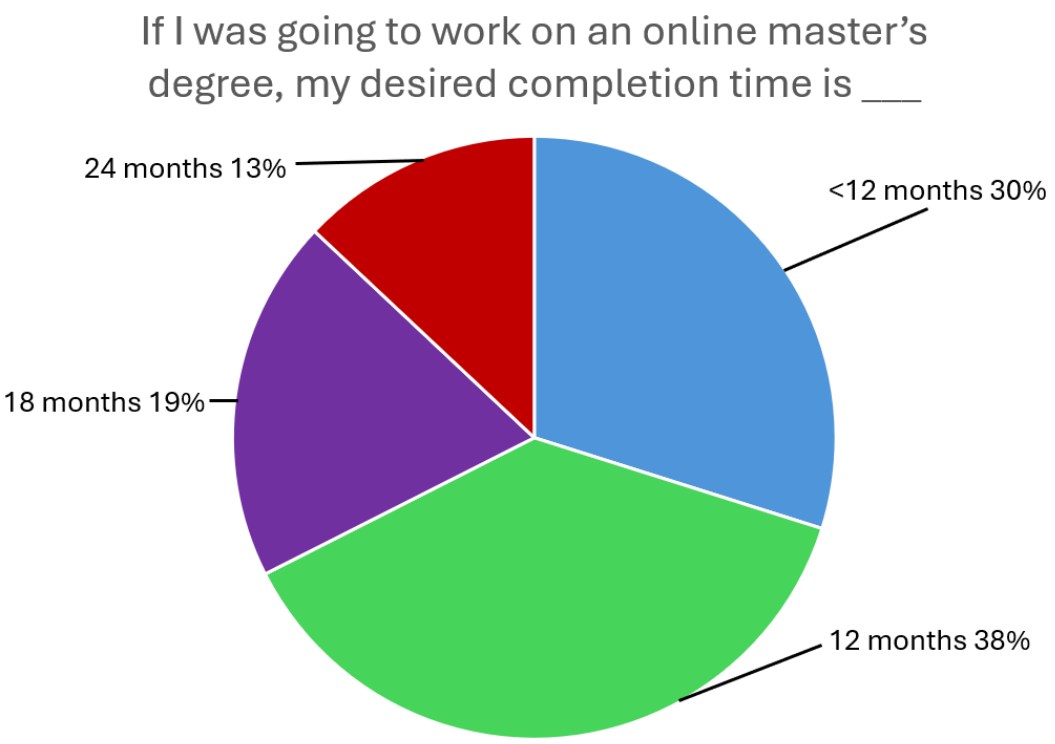

Figure 8: Desired online master's completion time

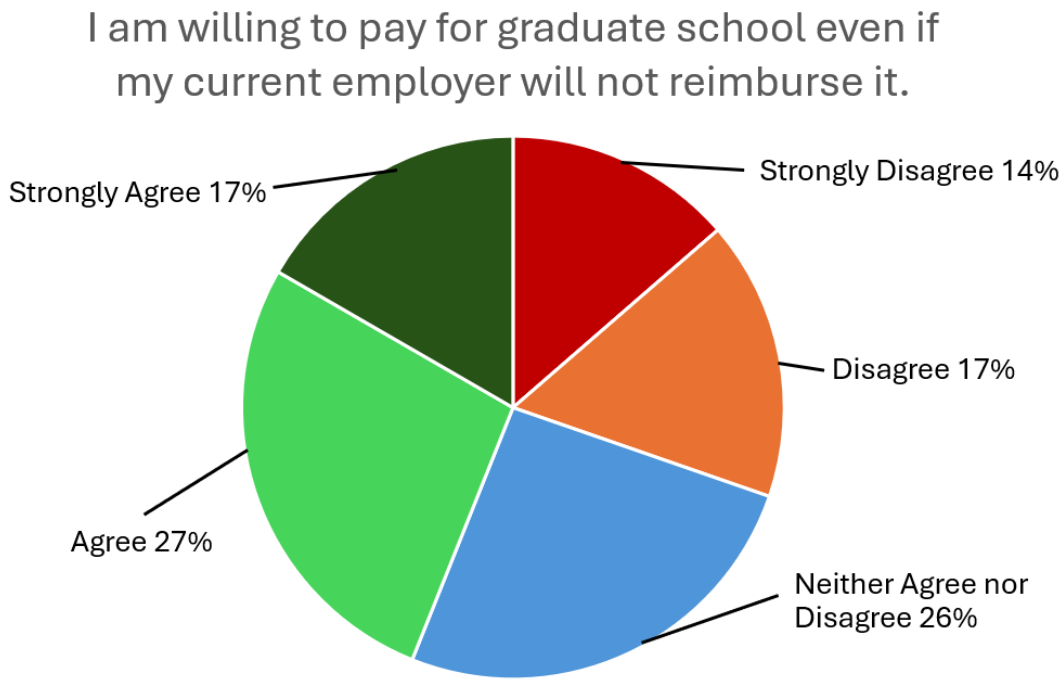

Figure 9: Students' willingness to pay for graduate school without employer assistance

Figure 10 is a compiled list of all the suggestions provided about how to customize online education to make a difference in their deciding to enroll.

Q9
Work with the SFS Cybersecurity plan. I would love to do this program as long as it does not conflict with the cybersecurity requirements.
Videos broken up by topics (short, sweet, and more videos rather than longer)
The option for asynchronous classes would be an important factor in my decision of enrolling as it would allow me to complete classes around my future work schedule.
The flexibility and time would make a big difference in my decision.
Talk about research in that area
Not having to attend live sessions and just being able to watch recording or just be able to do all the work on my own time
make program as efficient as possible to where you get the education at an affordable rate while also being able to build your career.
Make education as proportionally expensive as it was prior to government funding of college tuition so it's worth the money rather than gaining real experience immediately with a company.
It'd be cool to have a self-paced program.
I'm not interested in taking online courses, but if I would take one I would like for it to be more project/Practice based than exam based.
If there we're no set class times and the degree could be completed online
If there was a way to keep my schedule pretty laid back where im not stressed at work and fininsh in a timely manner that would be great
I would not know
I would like to know about breaks in between sessions.
I think the way the online customization is pretty good; I have no suggestions for improvement on that aspect.
I think the program as is is already so customizable and easy to access that anyone who wants to will be able to. My decision will fall on personal desire to get into industry more than it would be because of the ease of access.
I think simply having the option to do an online masters degree would make a huge impact.
I think just offering online courses would entice me to pursue the degree because I've never had the luxury.
I really enjoy keeping asynchronous classes flexible. A few that I have taken in the past required a lot more timed meetings during the day that I could not make since I was working full time.
I have taken online courses through Arkansas before and I like the format. As long as the classes are asynchronous I have no suggestions.
I do not have any suggestions about online education. Online education plays a minimal factor in my decision. Payment for the program is my main concern.
I do not have any detailed suggestions about how to customize my online education. I am not opposed to online or in-person education methods. I am interested in all master's programs such as MSIE, MSOM, and MSEM.
Honestly, the only reason I would really want to get a masters in PM is if my employer wants me to get one and will pay for it.
Having online classes without time-scheduled required class meetings would be extremely helpful so I am able to work and do classes simultaneously
Getting my master's degree is something that I have thought of, but I think it would be more beneficial to me to go into the workforce for a year or two and then see about doing something online.
Flexible hours and timely help from professors
Being able to take classes when I want, and allowing them to fit a full time work schedule would have a very big impact on deciding if I were to enroll.
Be able to take classes whenever, for example, maybe one month i am too busy so i decide to not take any classes but do take some the following month
Asynchronous is a big decider, but more than that, I believe assignments should be due at the end of the week so students can find time during their work week to work on them.
A detailed catalog of teachers and classes

Figure 10: List of suggestions to customize online education to decide to enroll

Figure 11 is a list of any other suggestions provided by the students.

Q11
This seems to be a good deal overall
Thank you for your time!
Thank you for taking the time to get our feedback and continue to improve your program!
Thank you for doing that graduate program speech in my class, it got me back on track to looking into it.
Presentation was very good and I am happy to give my feedback. Still unsure about grad school though.
One aspect that is not touched on too well is the classes and the expectations on that come with those classes. If I were to enroll online, how much work would I need to do outside of my 9-5 job?
My only idea would be to introduce the idea sooner so students can plan classes around that as halfway through junior year is a little late.
It was a great presentation and I am now interest
I would like to have more information about the Industrial Engineering On Campus M.S. Programs.Thank you.
I think this program is a very cool opportunity
I think i might be more interested in the operations management degree? But I'm just not sure which route i'd want to go with further studies yet :)
I have no other comments, it was a very insightful presentation
I do not have any further comments. The next steps for me are talking to my advisor and see what best fits me!
I am curious about where an engmgt master differs from an mba offered here at the UofA.
I am all for the programs! I think gaining a master's degree in just one additional year is a great idea. However, I know a lot of companies pay for master's degrees, so my original plan was to secure a job first and then come back to school after confirming my employer would pay for it. I would need to know more about the financial side of the MSEM program before committing.

Figure 11: List of any other suggestions

Combining the Likert scale results from Agree and Strongly Agree to represent affirmative answers, 65% of the students polled are NOT considering graduate school, and 27% would consider getting a master's degree online while working full-time. 34% of the students are interested in getting an MSEM from UARK while working full-time, and only 9% of the students found taking classes asynchronously online to be important to them. Similarly, only 11% are considering a graduate certificate if they could apply these four courses toward a master's degree, and 12% would be more interested in pursuing an MSEM from UARK versus elsewhere if they could apply four undergraduate courses to their ten courses required for a master's degree from the "4+1" program. Finally, 68% desiring of students desired completion time of a year or less, 19% at eighteen months, and 13% two years or more.

Conclusions

Approximately 35% (24 out of 68) of students polled are interested in going to graduate school and the same percentage are interested in pursuing the MSEM from UARK. This percentage agrees with data from the National Science Foundation (NSF) [5] and the National Center for Education Statistics (NCES) that report approximately 30-35% of U.S. engineering undergraduates pursue graduate degrees within a year of graduation [6].

Providing asynchronous online classes, graduate certificates, and even having the ability to apply four undergraduate classes toward the master's degree was not a significant consideration (all less than 12%). Most of the students prefer completion time to be one year or less (68%), and less than half (44%) of the students polled are willing to pay for graduate school out-of-pocket.

The suggestions collected from survey question 9 (suggestions to customize online education to

decide to enroll in a graduate program) that are listed in Figure 10 are focus on the preference of online / asynchronous classes, program efficiency and cost, course structure and delivery, support and timeliness, and general satisfaction with current options. Many students commented on the priority of being able to take classes asynchronously, allowing them the flexibility to complete their coursework around their work schedules and avoid fixed class times. Some students specifically mentioned the importance of not having live sessions, preferring to watch recorded materials at their own pace.

Students also commented on the importance of an efficient program that delivers high quality education at an affordable price, and some students suggested shorter, topic-focused videos, more project-based learning, and fewer exams. They would like the program to be customizable to their career needs, with some expressing a preference for self-paced programs.

Flexibility in scheduling, such as the ability to pause classes when they are busy and resume them later, was noted as important. Additionally, students wanted timely support from professors and clarity about breaks between sessions. Some students are already satisfied with the existing customization and accessibility of the program and indicate that personal factors, like career goals and financial support, will influence their decisions more than the format of the online courses. Overall, students want a flexible, affordable, and supportive online program that aligns with their career aspirations and allows them to manage their time effectively.

Question 11 of the survey asked for any other comments (Figure 11), and the comments provided relate to program interest, expected workload, timing/planning, consideration of other options, financial concerns, and MSEM differences from other master's degrees such as an MBA:

Many students expressed interest in the program, noting that the presentation about the MSEM program that was provided in the Project Management class was helpful and that the opportunity to pursue a master's degree in one additional year is appealing. Some are unsure about graduate school but appreciate the chance to explore it further. However, a concern was raised by some students is the workload involved, particularly how much time would be required outside of a typical 9-5 job if they enrolled in the online program. They would like more clarity on expectations for balancing coursework with professional responsibilities.

Some students suggested introducing the program information earlier, ideally before their junior year, to allow for better planning of their academic path. A few students expressed interest in other related programs, like operations management or industrial engineering, and are still undecided about which route to pursue for further studies. A common theme was the importance of understanding the financial aspects of the program, and some students plan to secure a job first, then potentially pursue a master's degree if their employer offers financial support. Students requested more details on specific areas such as differences between the engineering management master's degree and an MBA, and further information on the industrial engineering M.S. programs. Overall, students are interested in the program but would like more information regarding workload, financial details, and how the program fits with their career plans.

Preliminary findings highlight critical factors that engineering management educators should consider when evaluating alternative methods of program completion. The insights from this research will not only guide other universities in developing similar programs but also enhance the alignment of engineering management graduate programs with student expectations and career aspirations. The survey methodology, key findings, and implications for program development, positioning accelerated MSEM programs as a responsive and valuable educational pathway in engineering management education.

The survey results were analyzed by calculating the modal response (percentage) for each question. Because Likert survey data is ordinal in nature, it is inappropriate to report mean response values or use parametric testing procedures [7]. Although many authors ignore this distinction and erroneously apply parametric methods to Likert survey data, the results cannot be properly interpreted.

Discussion

The findings from this study provide important insights into student preferences and concerns regarding graduate education in engineering management. The approximately 30-35% of students nationwide that go on to pursue graduate studies demonstrates that interest in further education is substantial, making it crucial for institutions to understand the factors that influence students' decisions to pursue graduate programs like MSEM.

The preference for flexible, online, and asynchronous learning formats was a key finding from this study which highlights a desire for students to have control over their schedules and the ability to learn at their own pace. This finding suggests that other online graduate programs should prioritize asynchronous delivery and consider expanding opportunities for self-paced learning to meet student needs. It is interesting and surprising to learn that students showed limited interest in graduate certificates or applying undergraduate coursework to their master's degree as this was the initial reason for the survey. However, the finding that is clear is that flexibility in the program's structure is a primary consideration for most students.

Completion time and cost of the program were found to be significant concerns. Since the majority of students indicated a preference for a one-year completion time, this aligns with supporting an accelerated graduate pathway such that undergraduate students can take up to four approved graduate level courses that double-count to fulfill both undergraduate and graduate course degree requirements during their senior year. Because the master's degree requires taking ten courses, students can finish the master's degree with six additional classes making it possible to finish in one year after the four-year bachelor's degree, hence the name "4+1" typically seen at other universities. Further investigation is required for comparison of the success of 4+1 programs at other universities.

However, it is worth noting that less than half of the students were willing to pay for graduate education out-of-pocket, indicating that cost remains a significant barrier to enrollment. This finding highlights the importance of exploring financial aid options, partnerships with employers, or offering more affordable tuition models to make graduate education more accessible.

Many students showed concern about courseload expectations, particularly in relation to balancing graduate school with their job responsibilities. They also suggested introducing the accelerated master's degree (4+1) program information earlier than junior year to facilitate better planning and informed decision-making.

Furthermore, some students showed interest in comparing the MSEM program to other graduate options, such as industrial engineering and MBA programs. Therefore, it is advisable to provide clear distinctions between the various programs to help students make more informed decisions and ensure they understand the value proposition of programs like MSEM in the context of their career aspirations.

Lastly, the survey highlights the desire for a customizable, project-based learning approach with

an emphasis on affordability, efficiency, and support. These insights suggest that students are not only looking for flexible scheduling and cost-effective options, but also value high-quality, relevant content that aligns with their professional goals. Offering shorter, focused content, more project-based assessments, and timely support could help make the MSEM program more attractive and responsive to the needs of prospective students. Future studies will address employer perspectives on the UARK MSEM program as well as how the program curriculum compares to other EM programs.

In conclusion, by focusing on flexibility, affordability, and clear communication about program requirements, universities can position programs similar to UARK's MSEM program as a responsive, valuable educational pathway for students seeking to advance in the field of engineering management. Further research into the long-term impact of offering accelerated "4+1" master's degrees and how they influence student enrollment and career outcomes will be important for ensuring the continued success and relevance of such programs.

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Bibliographical Information

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