MESA — Mathematics Engineering Science Achievement

Advisor's Handbook

2016-2017

THE UNIVERSITY OF ARIZONA

Early Academic Outreach

Contents

Our Mission

AZ Mathematics, Engineering, Science and Achievement (MESA) is a program designed to increase access to Science, Technology, Engineering, and Mathematics (STEM) pathways and encourage college readiness for low-income, minority, or first-generation college bound students in grades 6-12.

Four Pillars of MESA

- Youth Inquiry – students learn and implement the MESA Engineering Design Process through numerous highly-engaging, relevant, hands-on activities in which their experience of project-based learning, while supported by the teacher, is driven mainly by student teams.
- Exposure to STEM – through college and career mentors and university campus events.
- College Readiness – through activities, resources and events developed by the UA Office of Early Academic Outreach as part of its Start Now college knowledge campaign (startnow.arizona.edu).
- Peer Support – by supporting the development of college-minded peer groups that support and encourage each other throughout the K-16 pipeline.

MESA USA

The AZ MESA program is based on a model that originated in 1970 at the University of California, Berkley. Established in 1984, AZ MESA has grown dramatically. Statewide programs currently provide thousands of middle and high school students with year-round support and college and career guidance.

AZ MESA is one of eleven national MESA programs. MESA programs are located in Arizona, California, Colorado, Hawai'i, Illinois, Maryland, New Mexico, Oregon, Pennsylvania, Utah, and Washington.

Goals

The AZ MESA Program is a structured, multi-year, precollege program dedicated to supporting and developing the interests, skills, and abilities of K-12 students STEM. The program aims to increase the number of engineers, scientists, mathematicians, and related professionals at technical and management levels in the workforce. Additionally, it serves to encourage and increase the number historically underrepresented and economically disadvantaged students in achieving academic and professional success in STEM fields. Through AZ MESA's efforts, participating students receive the educational enrichment experiences and support needed to achieve academic success and prepare for college STEM majors.

Educational Outreach and Activities

To achieve its goals, the AZ MESA program offers the following educational outreach components:

- Field trips and academic competitions
- College counseling
- Advisor Professional Development (MATI)
- Saturday Enrichment programs
- Scholarships/incentives
- Science, Technology, Engineering, Math (STEM) activities
- Industry Involvement

Industry Partnerships and Mentoring Programs

Southern Arizona industries work as partners with the Early Academic Outreach staff in a number of valuable ways, including providing engineers and other professionals to serve as mentors in the schools and funding programs and events such as MESA Day and the Engineering is Fun poster contest. Notably, the Tucson office of Raytheon supports the Adopt-a-School engineer program which won an award from the National Science Foundation. In addition, members of local area industries serve on the Arizona MESA Industry Advisory Board, which makes recommendations and decisions about issues related to MESA at the statewide level.

Contact Information

<u>Location</u>

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Advisor's Responsibilities

As a MESA Advisor, you agree to:

- Recruit 15 or more students to join MESA
- Hold weekly meetings
- Encourage and support college and STEM exposure
- Facilitate use of Engineering Design Process and Engineering Design Notebooks
- Share best practices with the MESA community
- Register students for competitions
- Incorporate college access monthly during meetings
- Have students fill out Student Information Form (SIF) and return them to MESA office
- Maintain communication with MESA office

Administration's Responsibilities

School administration agrees to:

- Identify and recruit advisor(s) for MESA
- Maximize opportunities for available funds to support MESA
- Encourage and support advisor participation in MATI
- Identify school facilities in addition to classroom, if necessary
- Support recruitment of students
- Support in gathering data for program evaluation
- Assist in finding district transportation to MESA Day
- Secure funding for MESA program fees
- Make every effort to compensate Advisor for their time in MESA financially
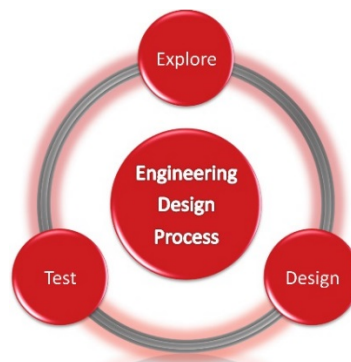
Ideas for Recruiting Students

One of the biggest challenges to running MESA can be recruiting students to the club. Students have a lot of choices for after school activities (sports, clubs, work, caring for siblings, etc.). The following is a list of ideas for recruitment. It is by no means all inclusive. Different strategies work at different sites. If you have something else that works, please use it and share it.

Personal Touch – Reach out directly to students

Students will come if they are feel a personal connection. Some of the best MESA students are those who come because of the advisor. Reach out to students and personally invite them. Ask Math and Science teachers to recommend students who may be interested and send them a note or visit them in class.

Meeting Time

Have the students set the meeting day and time. This does 2 things: 1) It gives the students a sense of ownership over the program and 2) It gives you a sense of when most of the students are available.

Advertise

Hang up posters to advertise your meetings. Put the meetings into the announcements. If you have video announcements, make a quick commercial. Encourage students to invite their friends. Have students post on social media. If possible, put previous year's projects on display. The more the word is out in the general public, the more diverse the students who attend.

Groups of friends

Research shows that when friend groups do an after school activity together, they are 50% more likely to stay in the program for the duration of the year. Friend groups offer support, comradery, and a set of dynamics to work together.

Structure

Have a plan for the meetings. Make them fun, engaging, and organized. The students don't want to sit in a class after school but you can provide a structure so the students feel that they aren't wasting their time. If you are unsure what to present, use the MESA Curriculum or have students plan the meetings.

MESA Meetings

Determine the weekly meeting time and location for students. A typical meeting may include the following agenda items:

1. Introduction of Guest Speaker (if applicable)
2. Team Building Activity
3. Attendance and Announcements
4. Administrative Business (forms due, academic status reports, etc.)
5. Activity (guest speaker, STEM projects, tutoring, career development sessions, college or financial aid workshops, goal setting and problem solving activities, tutoring, and/or guest speakers)
6. Activity Summary and Evaluation
7. Next Meeting/Activity (time/date/location)

The structure of your meetings is your choice. Find a structure that works for you. MESA is an academic club and needs to have a structure similar to a classroom. Always try to have a starting point and ending point for your time with the students.

Chaperones

When going to an event, chaperones are an important component. The University of Arizona is not responsible for you or your team members while attending any MESA event. Please make sure you:

- Have 1 adult for every 10 children
- Have cell phone numbers of all chaperones
- Let students know your cell phone number
- Have a pre-arranged meeting point in case someone gets lost
- Have student's cell phone numbers, just in case

We want to provide a safe and fun atmosphere for your students. Please help us to keep them safe.

Ideas for Funding

- 21st Century CCLC Grant – About 75% of MESA schools also have the 21st Century Community Learning Center grant. The mission of the grant is *"To assist 21st Century Community Learning Centers in building and sustaining comprehensive out of school time programs that provide high-quality academic enrichment opportunities for all children, and that meaningfully engage adult family members in helping their children succeed academically"* The 21st CCLC grant and MESA aim to provide the same thing to students. Ask your principal/site coordinator how you can get involved with the grant.
- Tax Credit Money - There are pools of tax credit monies. If you can get parents and/or businesses to donate directly to your program, that is always the best. If not, ask your principal about Undesignated Tax Credit Money. It is money that people and/or businesses have donated to be used as the school sees fit. Schools use it throughout the year for field trips, events, etc. It is a source of funding that can go quickly.
- Partnerships with companies – Go to local companies and ask for donations. Donations can be for money, supplies, or expertise (using tools, writing proposals, etc.). Some places (Home Depot, Lowes, Ace Hardware) will let you have unusable pieces of wood (i.e. a 2"x4" that they can't sell) for either free or a drastically reduced cost. You can write a letter asking for support and/or materials to any company. A good tip is to have students sign it as well.
- Start a GoFundMe account – GoFundMe is a great crowd sourcing site that can provide funding for materials. It works best when cast to a large audience. Have students post it on social media. Have the school post it on their social media. Have the district post it on their social media.
- Supermarket or fast food fundraisers – Some supermarkets (Fry's) and fast food restaurants (Rubio's and McDonald's) will sponsor schools and/or clubs by giving a percentage of proceeds from sales on a specified day to the designated groups. Contact stores to see if they offer this fundraiser.

Sample Donation Letter

Dear [Insert Name Here]

My name is [Insert Name]. I am writing you on behalf of M.E.S.A. at [Insert School Name]. M.E.S.A. is Mathematics, Engineering, Science, Achievement. The goal of the program is to excite first generation, minority, and low income students to become excited about Science, Technology, Engineering, and Math (STEM) careers. The program has problems that the students are to solve using these skills and compete with other students all over Arizona. You can find more information at the Arizona M.E.S.A. website. http://azmesa.arizona.edu

We are asking if you could donate materials to our efforts. We are looking for:

[Insert list of materials here]

We plan to use these materials to make

[Insert copy of design here]

We hope that [Insert Company Name] would be willing to donate some or all of these supplies to help us complete our project.

If you donate to our school, it is a charitable donation. Our school tax ID is[Insert Tax ID here]. We can also add your company logo to our final product and thank you in our presentation. We look forward to establishing a partnership with you and [Insert Company Name].

Thank you for your support.

[Team Members Names and Signatures]

[Advisor Name and Signature]

[Address]

[Phone Number]

[Email]

<p style="text-align:center; color:#4472C4;">Recommended Timeline</p>
<p style="text-align:center;">(Revise to reflect program implementation date)</p>

August

- Enlist the assistance of the "veteran" AZ MESA students and the math and science faculty to identify potential MESA students that meet the general requirements
- Attend MESA Advisors Training Institute (MATI)

September

- Organize the first MESA student meeting and select the meeting times and places for the remainder of the semester
- Describe MESA program so all members will remember the goals are college preparation and fun with math and science
- Discuss Science, Technology, Engineering, and Mathematics (STEM) as career options
- Introduce Engineering Design Process
- Begin to identify guest speakers for meetings, Raytheon partner engineer, and possible teams for competitions.
- If desired, start building trebuchet for Tucson Pumpkin Toss

October

- Introduce concepts that students will need as the begin preparing for competition
- Show students how to critically and comprehensively read the specifications
- Continue to discuss Science, Technology, Engineering, and Mathematics (STEM) as career options
- Continue to discuss the Engineering Design Process
- Participate in Tucson Pumpkin Toss (Oct 22nd)

November

- Continue introduction of important concepts
- Have students identify competition interests and build their teams
- Have students begin researching and brainstorming designs

December
- Have students develop of plan of action for design development
- Have students organize all notes, research, drawings
- Teams build projects based on designs, test, analyze, and generate improvements

January
- Teams re-visit plan of action and set calendar to be prepared for Regional MESA Day Competitions
- Teams build projects based on designs, test, analyze, and generate improvements

February
- Teams continue improving designs
- Encourage seniors to apply for MESA scholarship
- Participate in Regional MESA Day Competition

March and April
- Finalize teams and submit registration for MESA Day.
- Teams finalize designs, formally present their projects to their peers.
- Teams participate in MESADay (with College Signing Day & Student of the Year Recognition) on April 22 @ U of A.

May
- Teams reflect on performance at MESA Day.
- Youth Recognition and/or End of Year Celebration at Your School (_____)

Resources

Attendance Roster

MESA Team Attendance		MESA Regionals:		Teacher:
Fall of _____, Spring of _____		MESA Day:		School:
		Other MESA Events:		

		Directions: Write date/month in column header row.																
Student	Team(s)																	

MESA
Mini-Design Notebook

Name (Student/Team): _____

Design: _____ **Date:** _____

Design Cycle # (circle one)   1   2   3   4   5

Explore (Imagine/Brainstorm/Research)

Design Problem (in your own words)	
Success Criteria (e.g. height, speed)	**Constraints** (e.g. cost, materials)
Other Design Variables (e.g. Cost, Height, Wind, Energy)	
IMAGINE: Brainstorm What You Already Know Or Might Research? What Key Features Matter To You?	

Design (Draw and Build New Prototype or Modifications)

Goal & Why? (rationale for this cycle)	Plan for this cycle (e.g. timeline)

Sketches:

Test (Create Testing Process, Gather Data, Reflect)

APPROACH: What tools do you need to measure quality?

HYPOTHESIS: What do you predict for this round of testing – and why?

REFLECT: What worked – or didn't – with your latest design? What materials might you change? What features might you add? How might you improve your team's process in the next design cycle?

School: _____   **Design Team:** _____

MESA Design Goal Checklist
Plan & Prioritize

Priority (e.g. 1st, 3rd)	Goals	Team Members Responsible	Deadline	☑	To do at MESA only, outside of MESA or both?
	1.				
	2.				
	3.				
	4.				
	5.				
	6.				
	7.				
	8.				
	9.				
	10.				

Common Notebook Rubric

**Common Rubric
For Engineering Design Notebooks**

Rubric for Engineering Design Notebooks (EDN).

Note: Judges will only choose some categories to assess each team's Engineering Design Notebook.

EDN Goals	4	3	2	1
0. EDN Organization				
0.1 Structured. Includes Table of Contents, Glossary & Appendix so readers can easily find key elements of EDN as well as resources researched (citations) & vocabulary learned.	**Thorough** organization utilizes defined sections.	Basic...	Minimal...	No...
0.2 Readability. Notebook answers potential questions of reviewers. Highly readable notebooks are thorough, clear, legible & detailed (e.g. length & date of tasks documented) and provide summary updates when needed.	**All** questions reviewer might pose are clearly answered.	Most...	Few...	No...
1. Explore				
1.1 Problem Statement. Accurately articulates, in their own words, the design objective (includes success criteria, constraints)	**Specific** articulation of problem, success criteria, constraints	Basic...	Weak...	No...
1.2 Depth of Free exploration. Prior knowledge, brainstorming & hands-on exploration documented.	**Numerous** examples of brainstorming and hands-on exploration observations.	Regular...	Few...	No...
1.3 Research in STEM. Explores how math & science concepts inform project (e.g. math formulas, laws of physics, etc.), and how they might optimize their design considering the variables and constants involved.	**Clear** documentation of math & science concepts considered.	Basic...	Scant...	No...
1.4 Research in Design. Evaluates aspects of other designs that might be utilized or modified in this design (e.g. shape, functionality, efficiency, impact, cost, or other design parameters).	**Clear** analysis of other design pros/cons.	Basic...	Scant...	No...
2. Design				
2.1 Design rationales. Includes clear rationales throughout notebook on design choices (materials used, modifications, etc.). Choices are predominately based on data from past trials, research and design considerations rather than trial & error.	**Thorough** rationales given (based on data or research) for each design choice.	Basic...	Scant...	No...
2.2 Design plan. Prior to testing, team articulates project plan timeline, testing procedure & performance prediction (or hypothesis).	**Detailed** articulation of testing procedure & performance prediction or hypothesis.	Basic...	Scant...	No...
2.3 Design sketching and/or photos. Prior & during build, team sketches 2-D or 3-D perspective drawings.	**Numerous** representations of each design iteration.	Regular...	Scant...	No...
3. Test				
3.1 Observation. Clearly reflected through data & written observations (tables, graphs, labeled drawings, etc.).	**Numerous** presentation of relevant quantitative & qualitative data, graphs, charts that follow design progression.	Regular...	Scant...	No...
3.2 Reflection/Analysis. Assesses pros and cons of design/materials, testing procedure, etc. Returns to restatement of purpose. Applies test results and analysis to pose a theory, recommend and argue for a next step, predict a design impact, or draw an insightful conclusion.	**Detailed** reflection shows how design considerations and logic flowing from research, test analysis, etc.	Basic...	Scant...	No...
3.3. Team Assessment. Notebook shows evidence of team self-assessment, peer assessment, design status presentations to various audiences, etc.	**Detailed** entries show assessment of team's design process as evidenced by notebook.	Basic...	Scant...	No...
4. Overall Use of Design Process				
4.1 Use of Engineering Design Process and/or Scientific Method is carefully & consistently documented so that steps are logically & sequentially connected.	**Consistent**, high-quality documentation of all aspects of design process	Occasional	Scant...	No...
Column Totals (for selected categories)				

Comments/Suggestions:

Total: ☐

× ?

Final Score (out of 7) ☐

Scholarship WebSites

Scholarship Universe – U of A site for scholarships. Most are for U of A but there are non- Arizona scholarships. https://scholarshipuniverse.arizona.edu/suha

ASU Scholarships – ASU site for scholarships. https://students.asu.edu/scholarships

NAU Scholarships – NAU site for scholarships. https://nau.edu/finaid/aid-types/scholarships/

GCU Scholarships – GCU site for scholarships. http://www.gcu.edu/admissions/tuition-and-financing.php

Fast Web –A terrific, free resource where you'll find thousands of scholarships at your fingertips. Not only does Fastweb offer a massive database of monetary awards, but it also features helpful career planning services and learning tools for its registered users! http://www.fastweb.com/

Cappex – A site that will help find scholarships throughout college as well as college searches. Very thorough and offers a $2,500 scholarship to current college students. https://www.cappex.com/

College Success Arizona – A program designed to help Arizonans finish college. http://collegesuccessarizona.org/college-success-services/our-scholarships/

Scholarships.com – The name says it all. A resource with scholarships for any level of college. https://www.scholarships.com/

Big Future – Collegeboard's site to search for scholarships. Students do not need to be AP students to apply. https://bigfuture.collegeboard.org/scholarship-search

Unigo – A scholarship site that has categories to help guide to the scholarship that is right for you. https://www.unigo.com/scholarships#fromscholarshipexperts

Super College – A site to help you throughout your schooling. Has college and scholarships for any student at any level. http://www.supercollege.com/

My College Scholarship – A resource of the best methods to find and earn scholarships. http://www.mycollegescholarship.org/

Yes College – A huge collection of scholarships categorized by who can apply. http://yescollege.com/scholarships/