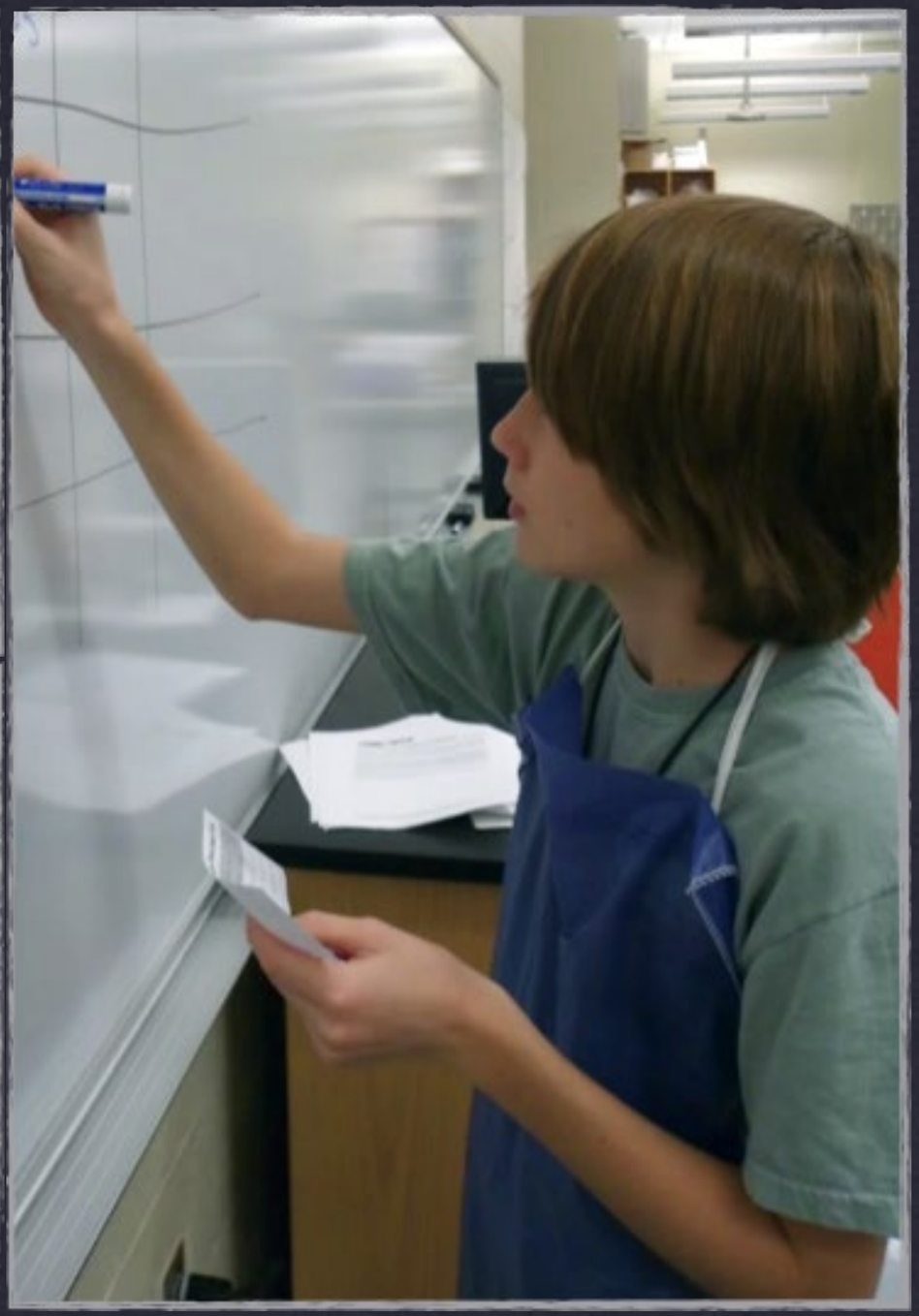
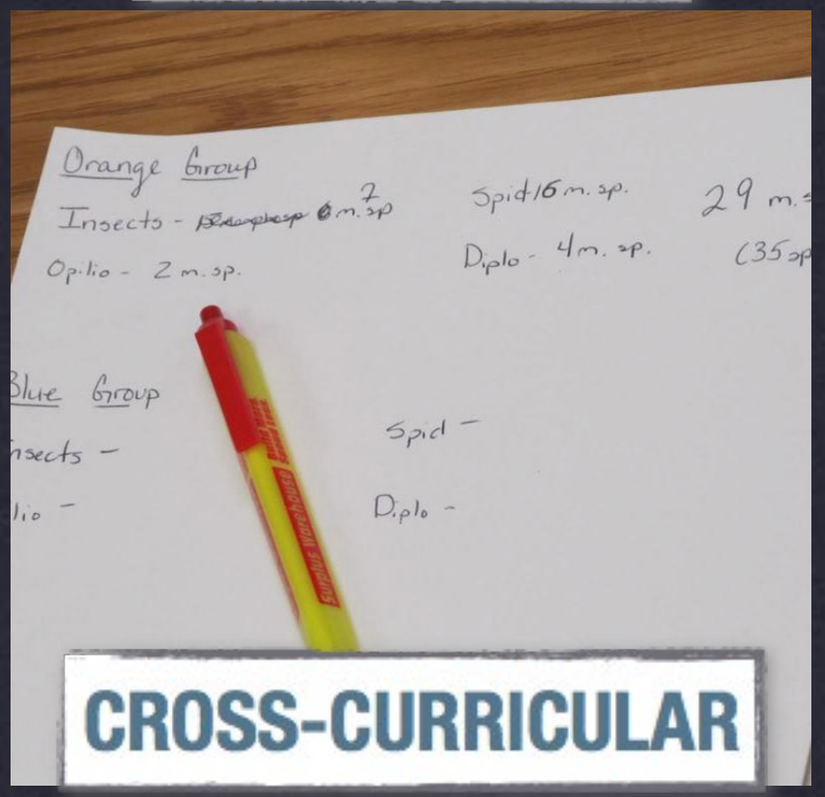


Science Fair

GEARSEF Teacher Workshop

October 17, 2019

ALABAMA SCIENCE TEACHERS



motivation: STUDENT BENEFITS

Did YOU ever do a Science Fair Project?

- Today's science fair projects…
  - Engage students in the scientific research process :

Develop a testable question
Find a way to test the question:
  - Materials
  - Methods/Procedure
  - Collect data
  - Interpret the results

Communicate the findings:
  - Display Board
  - Verbal Communication
  - Research Paper (optional)

logistics: WHAT IS SCIENCE FAIR?

logistics: FROM YOUR SCHOOL TO ISEF

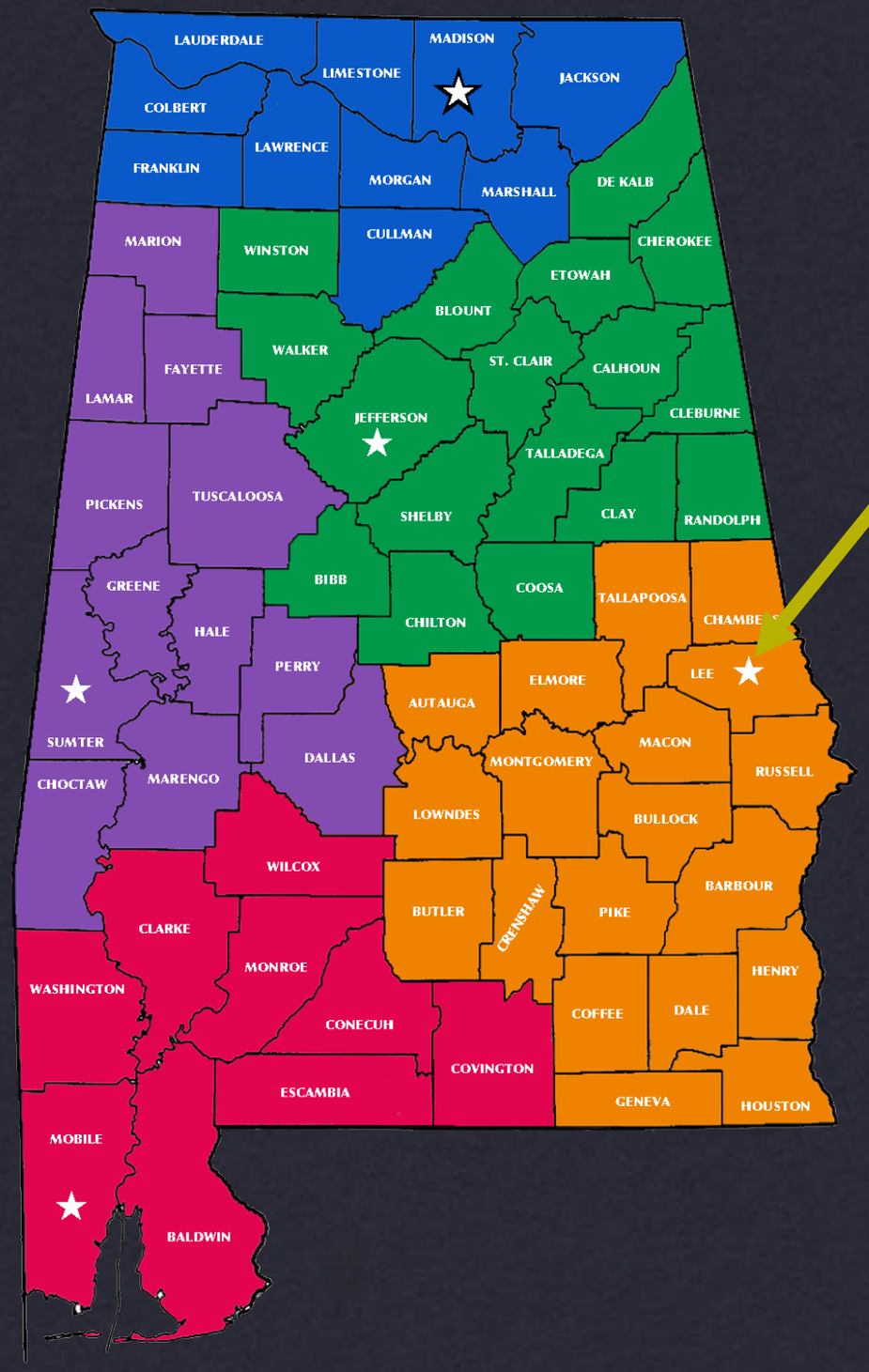
5 Regions in Alabama

Greater East Alabama Regional Science & Engineering Fair (GEARSEF)

19 counties in AL
Grades 6 - 12 eligible
Public, private, & home schools

Alabama State Science and Engineering Fair (ASEF)

hosted by Auburn University



logistics: ALABAMA FAIRS

GEARSEF 2020:

250 total project entries

Jr Div projects - 150

Sr Div projects - 100

268 students from 35 schools

(59% female 41% male)

Advancement to ASEF 2020:

49 projects (~22%) advanced to Alabama State competition from GEARSEF

Broadcom MASTERS Winners:

17 Jr Division projects advanced to Broadcom

logistics: GEARSEF REGIONAL WINNERS 2020

WINNER DEMOGRAPHICS

ASEF Winners:

49 projects advanced

Jr. Division - 13 placements, 11 HM

Sr. Division - 19 placements, 6 HM

ISEF Winners:

GEARSEF → 2 winners

ASEF → 2 winners

(1 of these students was awarded 2nd place internationally in his category)

Broadcom MASTERS:

1 - 8th grader made Top 300 in the country

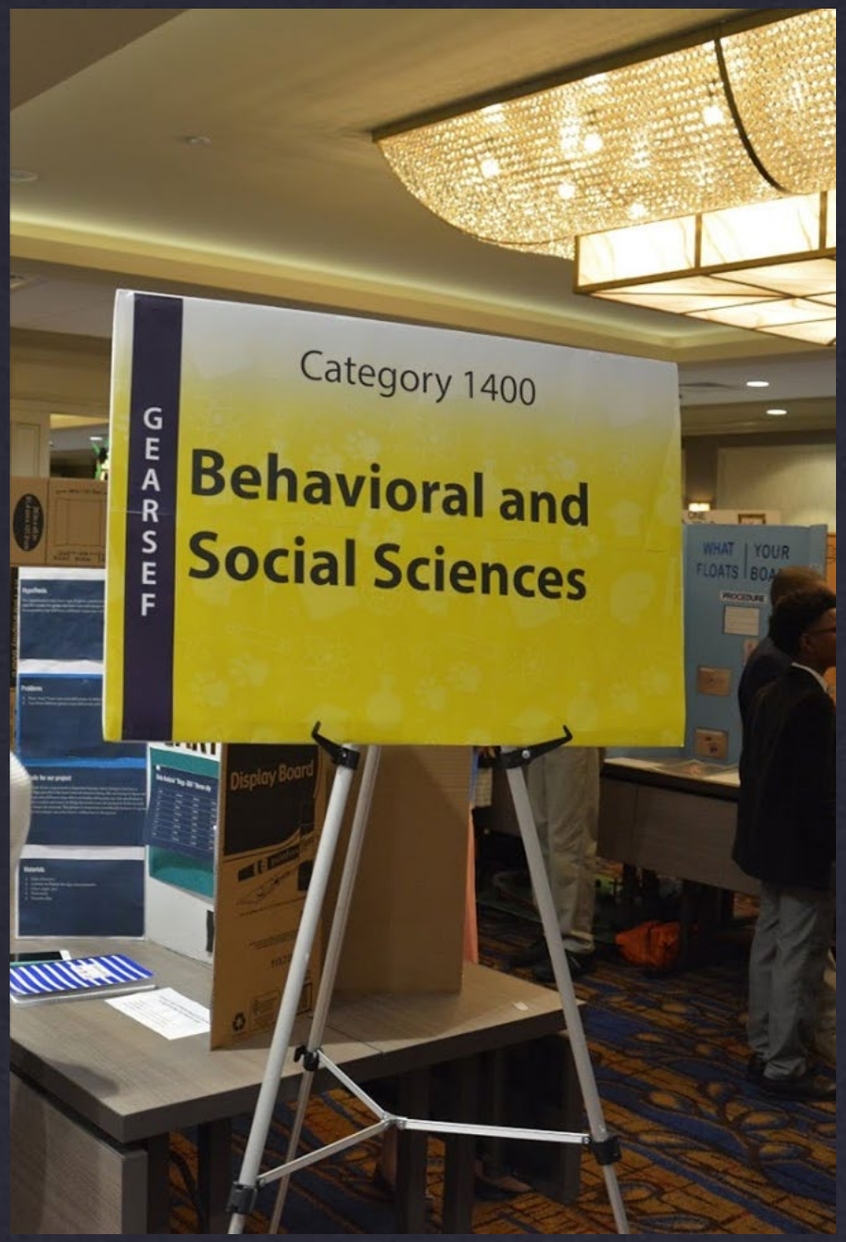
logistics: GEARSEF REGIONAL WINNERS 2019

Science Fair - The Movie (2:13)
https://www.youtube.com/watch?v=qFb6gM6_dnM

ISEF PROMO VIDEO (2:39)
https://www.youtube.com/watch?v=NbcbU0aZ678

logistics: Intel ISEF

GEARSEF CATEGORIES: GRADES 6 - 12



100 – Animal, Plant, Computational & Bioinformatics Sciences

200 – Behavioral and Social Sciences

**300 – Cellular, Molecular, Microbiology & Biochemistry (Senior Division Only)

400 – Chemistry

500 – Engineering Mechanics

600 – Energy: Sustainable Materials & Design

700 – Earth and Environmental Sciences

800 – Medicine, Health & Translational Medical Science

900 – Physics, Astronomy, Mathematics & Materials Science

1100 – Robotic Systems & Communication Technology

1200 – Bio-Engineering

logistics: CATEGORIES

RESEARCH PLAN & ABSTRACT

Handled in Scienteer Paperless System

PROJECT DISPLAY BOARD

Trifold board and Virtual Display Board

INTERVIEW WITH JUDGES

In-person event or via Zoom if virtual

SCIENCE DATA BOOK OR JOURNAL

Should be available upon request from judges

RESEARCH PAPER (OPTIONAL)

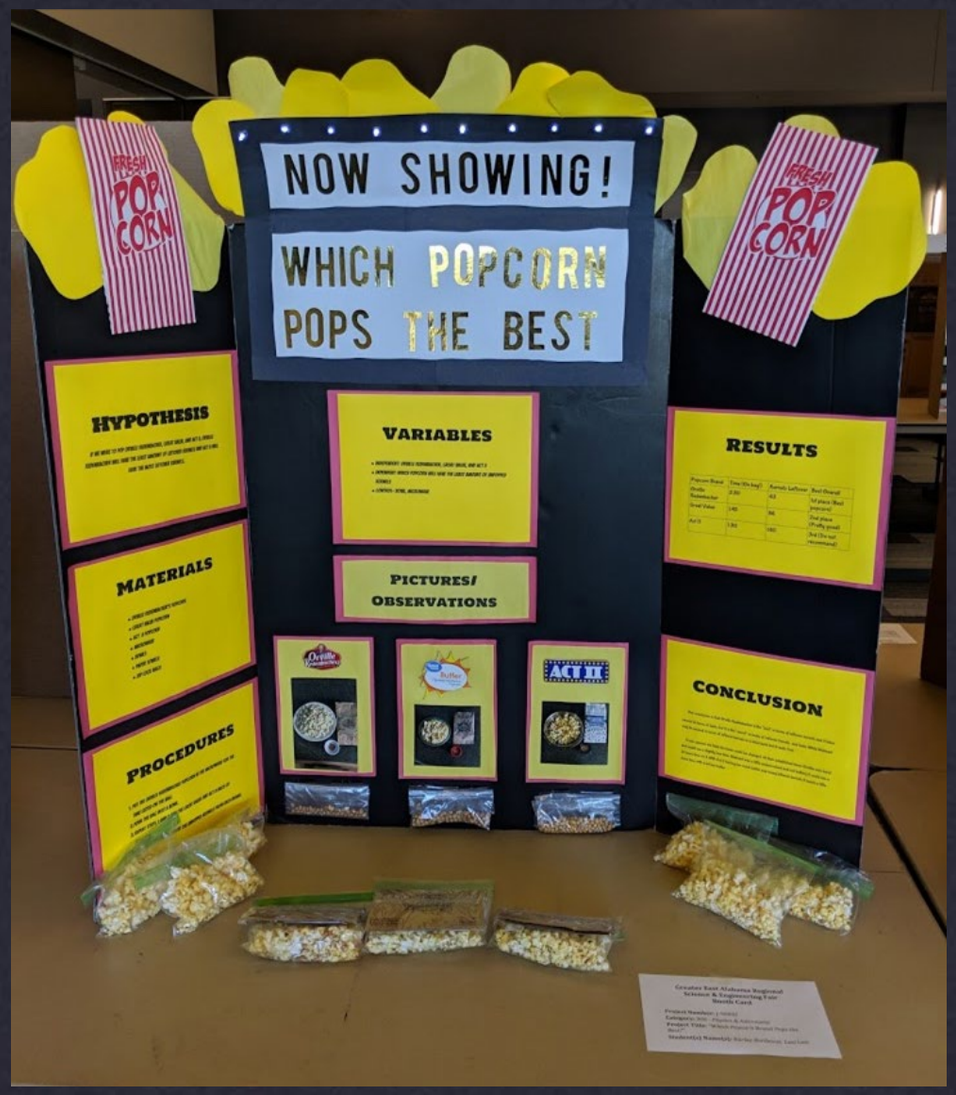
Expected at ASEF/ISEF but not collected at Regional Fairs

logistics: WHAT ARE COMPONENTS OF A PROJECT?

JUNIOR DIVISION

GRADES 6 – 8

- Choose a topic to explore
- Develop a question and hypothesis
- Design a procedure to test a variable
- Collect data accurately and reliably
- Construct graph(s) that displays data collected
- Develop a cohesive conclusion:
  - Does data support or void the hypothesis?
  - Are there sources of error in experimentation?
  - Are there other questions the student could explore after testing?
- Communicate the results of the study with an effective display board

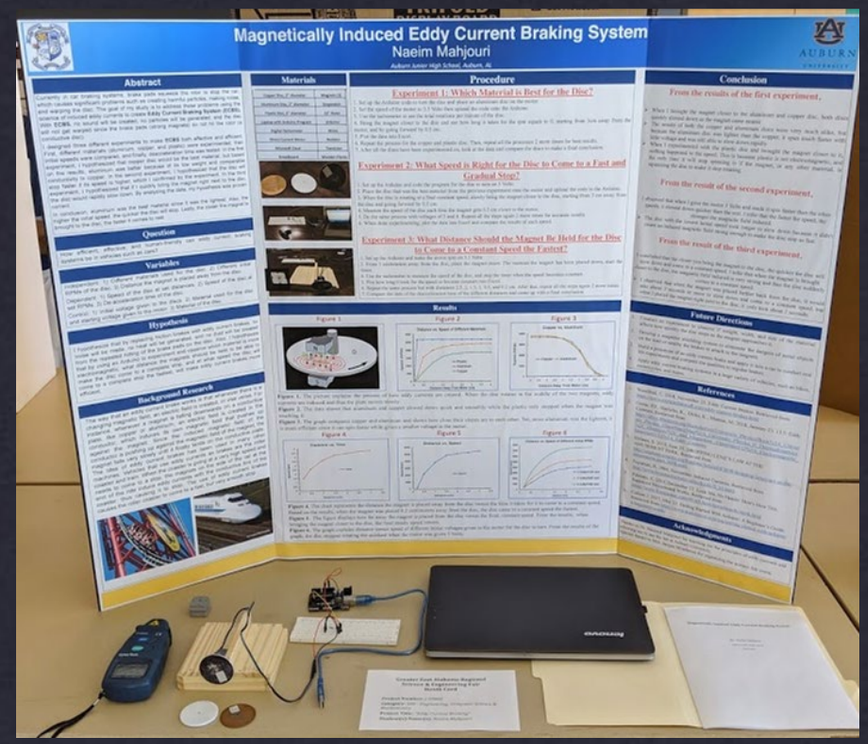


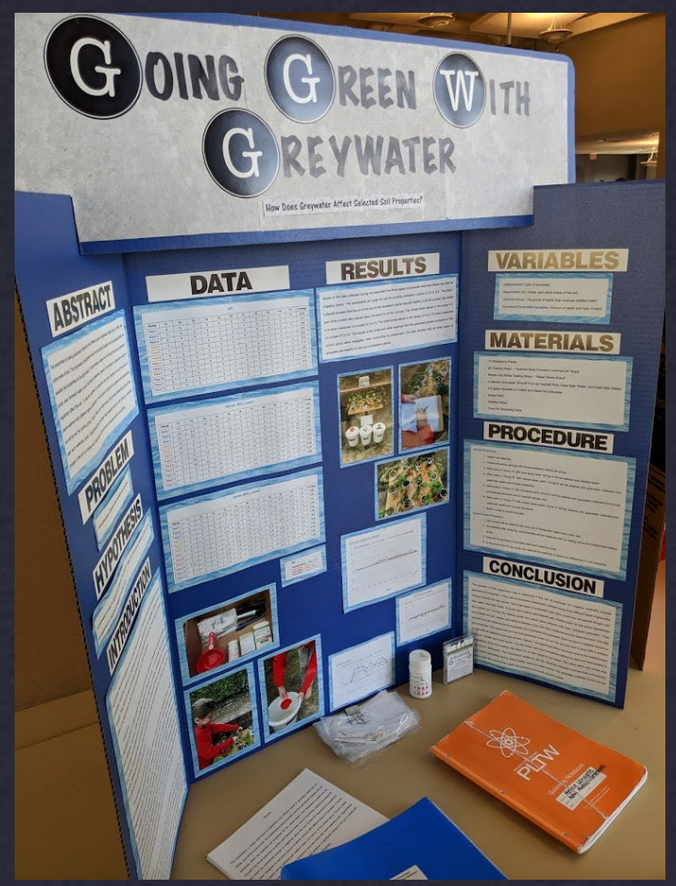
logistics: GRADE DIVISIONS

SENIOR DIVISION

GRADES 9 - 12

- Choose an original/unique topic to explore
- Conduct background research on the topic
- Develop a question and hypothesis
- Design a procedure to test a variable
- Collect/Analyze data accurately and reliably
- Graph data appropriately to display data accurately
- Develop a cohesive conclusion:
  - Does data support or void the hypothesis?
  - Are there sources of error in experimentation?
  - Are there other questions the student could explore after testing?
- Communicate the results of the study with an effective display board
- Communicate the results of the study with a well-developed research paper (recommended)





logistics: GRADE DIVISIONS

JUDGING CRITERIA - see scoresheet handouts

- **Research Question - 10 points**
  Demonstrates clear and focused purpose of study

- **Design and Methodology - 15 points**
  Focus control groups & procedures to ensure only a single variable is tested

- **Execution - 20 points**
  How well is the data collected, analyzed, and interpreted

- **Creativity - 20 points**
  With regard to uniqueness of study or creativity in execution of the project

- **Presentation - 35 points**
  With regard to interview with judges, written work and the poster display

logistics: FAIR DAY JUDGING

GEARSEF DATES

- **Fall Semester**

  GEARSEF School Fair/District Fair registration using Scienteer System

- **December - January**

  Classroom/School and/or District fairs held

- **February 18, 2022**

  Advancing Projects to GEARSEF - paperwork deadline

- **March 3, 2022 - GEARSEF at Auburn University**

  AU Virtual Exhibit Hall in place in case the event goes virtual

- **April 4 -8, 2022 – ASEF**

  Event will be held virtually at AU Virtual Exhibit Hall

logistics: IMPORTANT DATES

What do you need to know to host a “fair”?

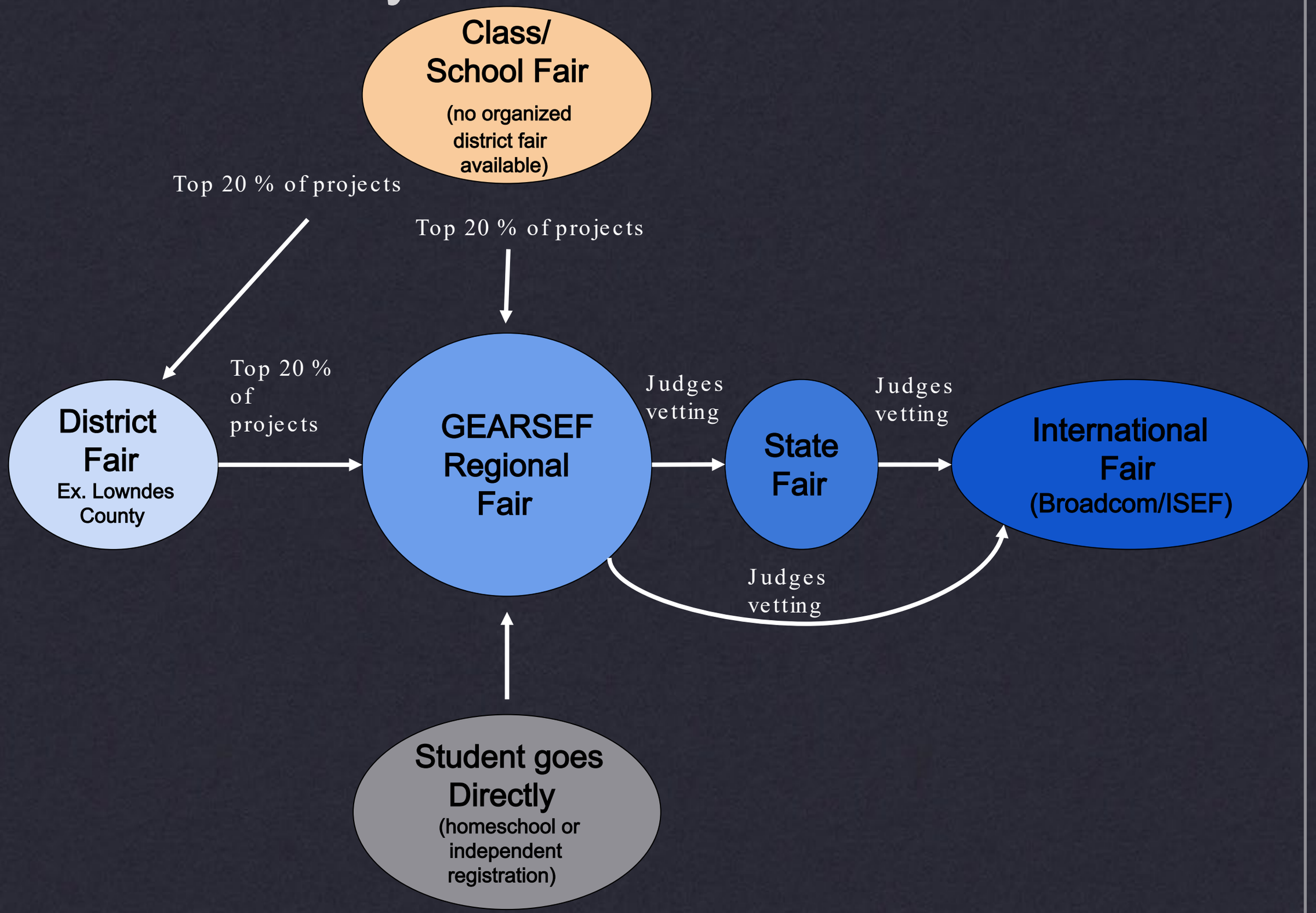
Fair hierarchy

Rules and forms

Oversight & committees

Building Your Support System

GEARSEF Hierarchy



What do you need to know?

Fair hierarchy

Rules and forms

Oversight & committees

Building Your Support System

Rules are for protection

- **Rules for projects & procedures available online**
  - Google - "ISEF rules"
  - mainly affects how to handle "complicated" projects

- **Display rules for project boards**
  - Google - "ISEF display regulations"
  - pretty basic rules for GEARSEF
  - much more stringent for ASEF & ISEF

- **Proper documentation paperwork is CRUCIAL**
  - Scienteer online software helps teachers and students complete paperwork correctly the first time.
  - If students are completing the initial questionnaire accurately, the correct forms will be generated for most projects (unless the project deals with a "complicated topic".

What ‘s a “complicated” topic?

Human Subjects

- when students collect data from a person (including themselves) even if data is collected anonymously
  Ex. surveys, measurements, testing prototypes etc.

Vertebrate Animals

- Nearly all interactions with vertebrate animals are included here
  Ex. hatching eggs, changing diets, setting up lures in the wild etc.

Potentially Hazardous Biological Agents (PHBA’s)

- Most microbiology work (some exceptions) and tissue/fluid samples
  Ex. blood samples, growing cells, swabbing petri dishes etc.

Anything else considered “hazardous”

- Dangerous chemicals, projectiles, lasers, dangerous machinery or devices should be handled with increased supervision to ensure proper safety rules are followed
- **See the ISEF rules page for specifics.**

Forms cheat-sheet

Everyone	Form 1, 1A, 1B (Scienteer will force all these)
Human subjects	+ Form 2 (qualified scientist form, may be needed) + Form 4 (human subjects form), IRB may require other documentation (like a sample of survey used)
Vertebrate animals	+ Form 2 (qualified scientist form, may be needed) + Form 5 (vert animal form)
Potentially hazardous biological agents (cells, tissues, fluids, etc.)	+ Form 2 (qualified scientist form, probably needed) + Form 6A/6B (PHBA risk assessment/Tissue form needed depending on sample used)
All other risky stuff (firearms,chemicals, machinery, etc.)	+ Form 2 (some cases if special expertise needed) + Form 3 (Risk form, err on the side of caution)
Continuation project (work from a previous year)	+ Form 7 (Continuation Form)
Research institution setting (work done at a place other than home, school, or field)	+ Form 1C (done after experimentation)

What do you need to know?

Fair hierarchy

Rules and forms

Oversight & committees

Building Your Support System

Why is oversight needed?

https://www.youtube.com/watch?v=5ohlA__xABw

Levels of oversight needed

- Supervisors
  - Parents - have to sign off on the project giving permission to participate
  - Adult Sponsor/Designated Supervisor - the person who directly oversees student and helps them complete the forms (teacher)
  - Complicated projects may need a person with specific skills/knowledge to serve.
    - Qualified Scientist - a highly skilled individual may be needed to supervise the project for especially complicated projects (bacteria etc),

Levels of oversight needed

- Committees
  - Scientific Review Committee (SRC) - Reviews safety, ethics and rules for all "complicated" projects
  - Institutional Review Board (IRB) - Reviews safety, ethics and rules only for HUMAN subject projects

    - Each committee has 3 members (often requires a PhD member)
    - Committees can share members
    - Committees can't include a project's supervisor or family member in the review stage of the project

Don't wait till the last minute to set this up. Chances are at least ONE of your students will have a project that will need SRC/IRB approval BEFORE they can begin their project.

What do committees actually do?

SRC reviews:

- scientific rationale/defined outcomes
- hypothesis clarity
- appropriate procedure design that upholds ISEF rules
- valid & reliable proposed measurements
- adequate proposed statistical analysis

IRB reviews:

- scientific rationale
- are risks minimized
- are risks reasonable to anticipated benefits/outcomes
- was there informed consent of participants
- avoidance of vulnerable populations

SRC/IRB Basics

- Both review safety, ethics and regulations
- Both are intended as PRE-project checkpoints (signatures required on the forms)
- Both are comprised of at least 3 members

Neither should have any “conflicts of interest” (i.e. teacher, parent or qualified scientist shouldn’t be reviewing a project of someone they are related to)

SRC Specifically:

1. Reviews “complicated projects” (except humans)

2. Comprised of (direct ISEF quote):
   - *A biomedical scientist with an earned doctoral degree
   - An educator
   - At least one additional member

*The “biomedical scientist” can be stretched some
Ex. A PhD biologist or doctor for cell work, a vet for animals etc.
<u>Terminal degree is important though.</u>

IRB Specifically:

1. Reviews ALL human subject projects

2. Comprised of (direct ISEF quote):
   - An educator
   - A school administrator
   - *A medical or mental health professional

*This can be anyone who can evaluate human risk/ethics - registered nurse, physician's assistant, MD, psychologist, licensed social worker or licensed professional counselor

NOTE: It is possible for a project to need both an IRB and SRC (i.e. human tissue samples)

Additional expertise…

You may still need an additional expert on your review team to sign off on some specific projects

Ex. animal projects *require* a veterinarian etc.

In some cases you can simply document a discussion with the expert and that will suffice.

When should SRC/IRB get involved?

If a project requires SRC/IRB approval, these signatures must be on file in Scienteer BEFORE the student(s) begins ANY work on their project.

Tips on finding your committee:

Student parents - may fulfill criteria (they just can't serve for their own student)

School staff - a teacher with a Biology PhD for SRC, School Nurse or Counselor for IRB

Local industry - hospitals, businesses, doctors offices, etc.

**Consider grouping up with a nearby school to combine resources

What do you need to know?

Fair hierarchy

Rules and forms

Oversight & committees

Building Your Support System

How to Build a Sustainable Fair

Recruiting Students

Logistics & Marketing

Oversight Committees

Judging

Awards & Morale

SCHOOL/DISTRICT TEAM ACTIVITY

How to Build a Sustainable Fair

Recruiting Students:

1. Be creative - Most successful school programs have started by making projects mandatory for class. Voluntary clubs have the lowest sustainable success rates.

Schools where teacher is operating alone send Top 20% to GEARSEF. Schools with multiple teachers send Top 20% to school fair and highest scoring projects advance to GEARSEF.

https://www.chino.k12.ca.us/domain/5813

How to Build a Sustainable Fair

Recruiting Students:

2. Be resourceful - Programs like STEM Discover Day, Engineering Day, Southeastern Center for Robotics Education (SCORE) camp etc expose students to new topics of interest to explore.

3. Be patient - It may take a year or two to begin see your science fair culture grow in your school. Allow younger students to tour the class/school fair.

How to Build a Sustainable Fair

Recruiting Students:

4. Be Organized – Systematic planning helps build support from administration, parents and community which will expand your marketing and awards ceremony.

5. Be Honest - Prizes will incentivize students and impact the success of your program.

How to Build a Sustainable Fair

Logistics & Marketing

1. Planning starts in the Spring - especially if you are making it mandatory for all students.

2. One teacher cannot plan the entire thing - you will need help! Identify your teachers/parents/faculty and PTO support team.

3. Pull in groups on campus to help with Marketing - art classes, graphic design students, web design classes etc to advertise on school website, school marquee, vinyl banner, school newsletter, announcing winners.

How to Build a Sustainable Fair

Logistics & Marketing

4. Connecting with the community to establish a wide variety of prizes to award to winners (content, technique, display etc.)

5. Be sure to thank business sponsors to ensure their continued support. Share their logos, send them a group photo of winners, help them see the difference they make to your program.

How to Build a Sustainable Fair

Oversight Committees

1. Fair Admin will set up SRC and IRB members list in Scienteer .
2. Committee members will get an email from Scienteer to establish their account.
3. Students' responses to their questionnaire will determine if SRC/IRB approval is needed. If a review is warranted - the system will not allow the student to proceed until approval is granted. (SRC/IRB approval must go through Scienteer - NO PAPER SIGNATURE)
4. Scienteer will auto populate signatures of approval when appropriate.

How to Build a Sustainable Fair

Judging

1. Seek judges who have a science background when possible.

2. Provide judges with a score sheet/rubric, clipboard, pen, snacks

3. Each project should be scored at least twice and scored averaged. Judges should not be asked to judge more than 10 projects.

4. Projects should be clearly numbered. Pre -assign judges to specific projects to ensure all projects get scored twice.

5. Judges should always interview students when possible.

How to Build a Sustainable Fair

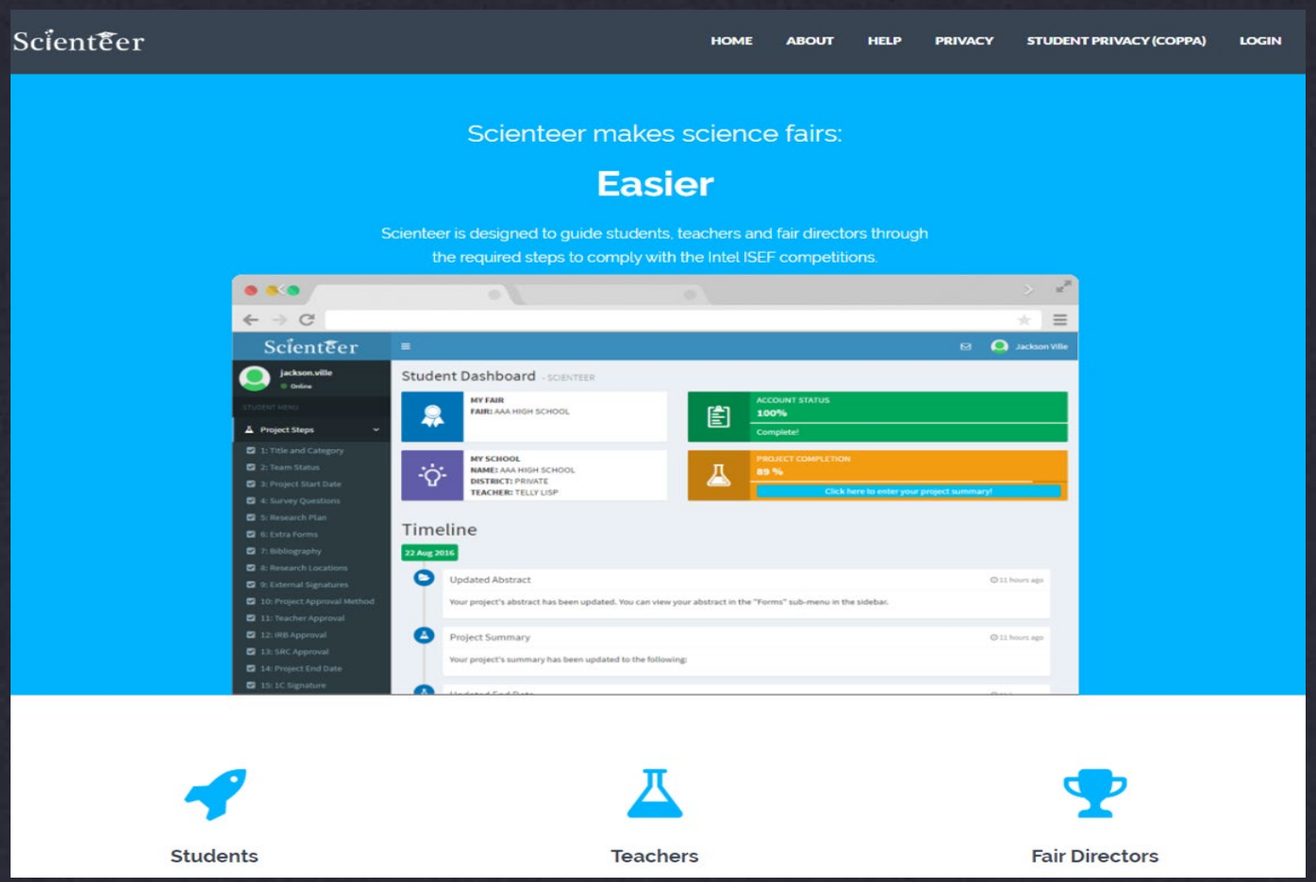
Awards & Morale

1. 1. Your awards can/should be tailored to your fair
   1. needs and resources.
2. Awards can range from “1st, 2nd, 3rd”, “Best of Fair”, “Most Creative Procedure”, “Best Use of Mathematics”, “Most Original Question” etc.
3. Awards can be certificates, gifts cards, T -shirts and school swag
4. Look to small business owners, PTO and corporate sponsorships (Walmart, Target, Sam’s) for gift cards.

LUNCH BREAK

How will you manage this?

Welcome to Scienteer



https://www.scienteer.com/

Scienteer Teacher/Admin Roles

Fair administrator (GEARSEF/District/School)

Sets up the dates, categories etc of the fair

Sets up teacher's accounts→(teachers then add students)

Selects the final winners

Teacher

Reviews projects as students are working & offers feedback

Considered the "adult sponsor/designated supervisor"

IRB/SRC Members

Reviews student research plan as needed PRIOR to starting

Others

Some like the "qualified scientist" or parents don't have an account. They just get a link they can use to digitally sign what's needed.

How each group gets their account

GEARSEF Administrator (Janie Marino)

Sets up all District Fair Coordinators in Scienteer

School Fair Administrator

Follows the link from their District Fair Coordinator (OR from GEARSEF if there is no district fair)

Teacher

Is set up by the School Fair Administrator

IRB/SRC Members

Is set up by the School Fair Administrator

Students

Follows the link sent from the School Fair Administrator (or forwarded through the teachers)

****You can have multiple roles simultaneously!**

How each group gets their account

GEARSEF Administrator - (Janie Marino)

Sets up all District Fair Coordinators in Scienteer

✔ **Janie "opens" fair and notify Fair Administrators**

→ Fair Administrators enter fair details, sets up SRC/IRB and "opens" fair and notify teachers

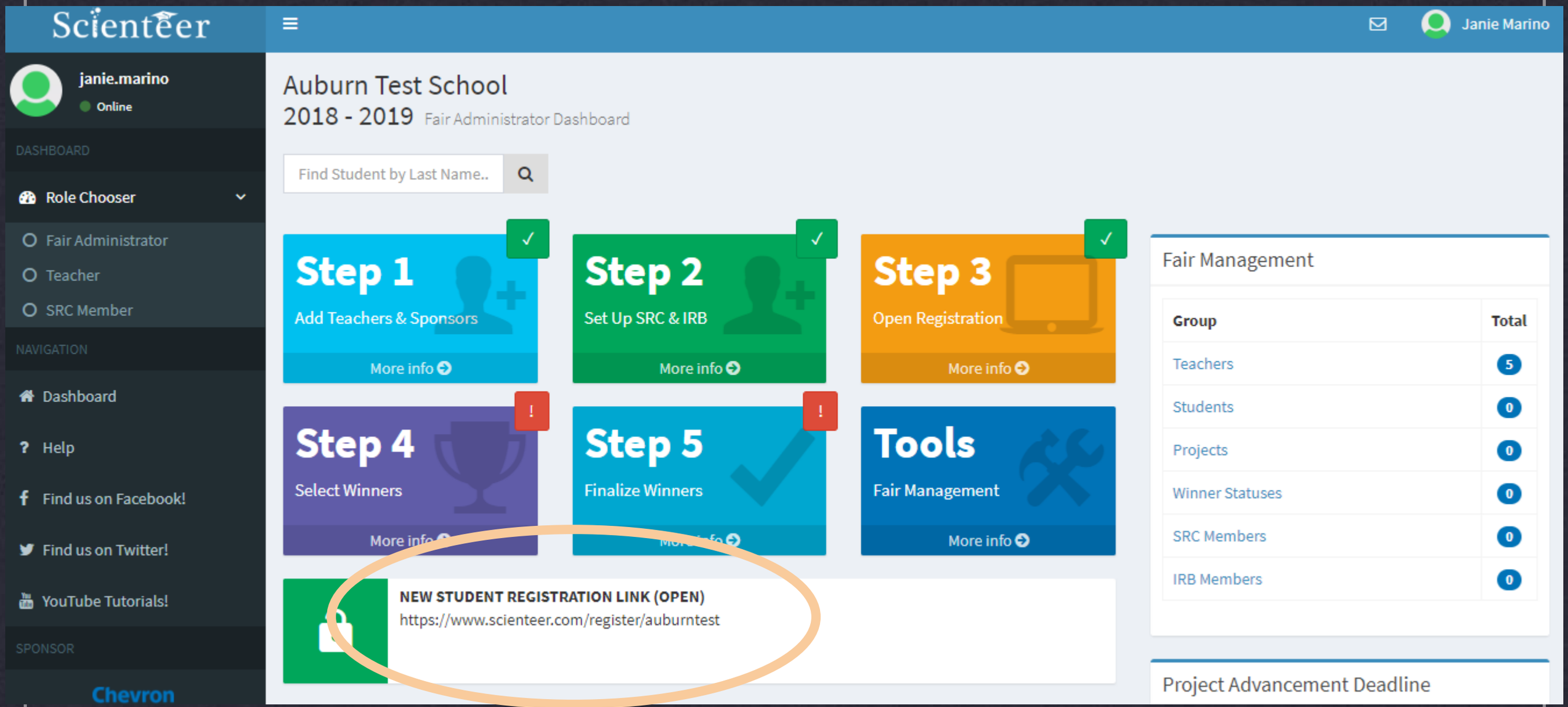
→ SRC & IRB members get an email from Scienteer to confirm their role

→ Teachers share link with students to setup their account

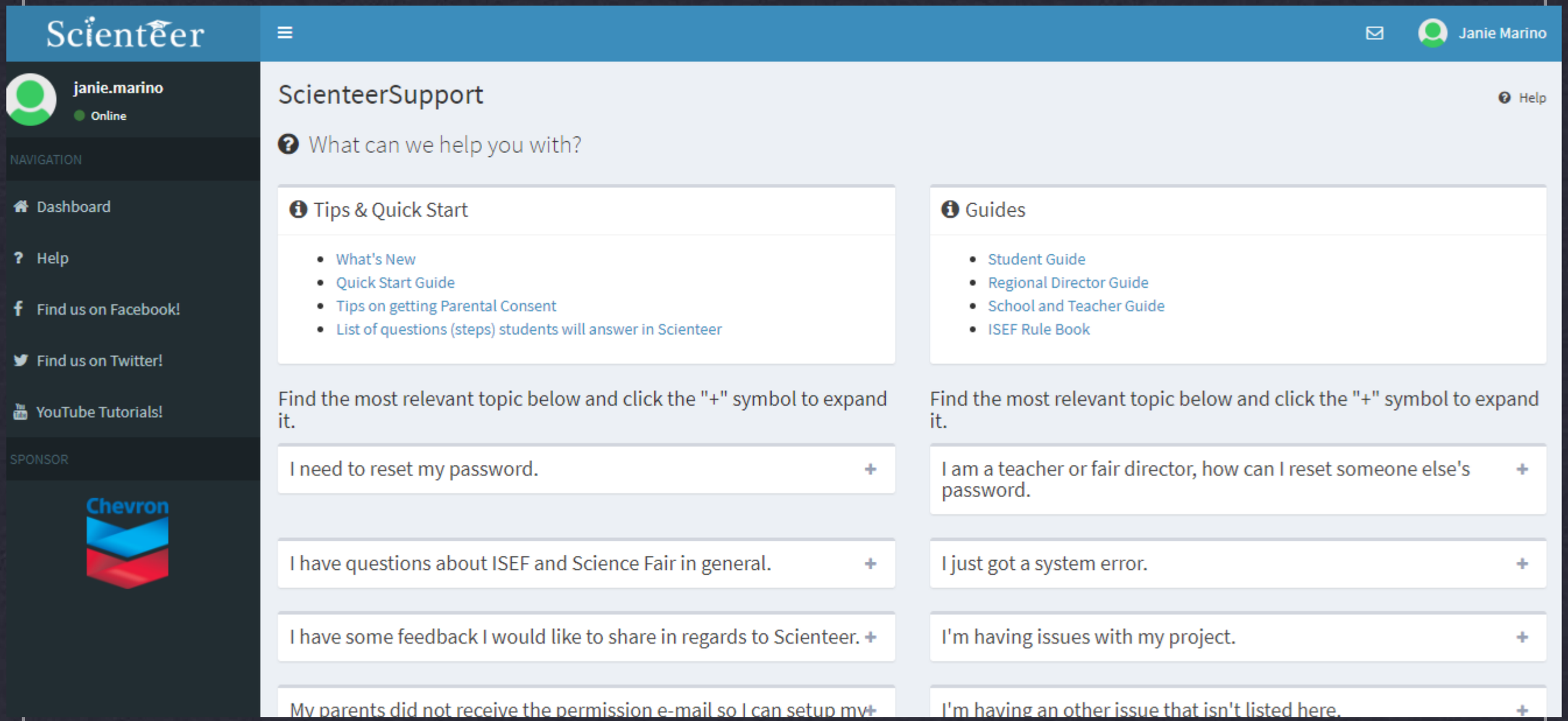
****Teachers can have multiple roles simultaneously!**

Scienteer Dashboard

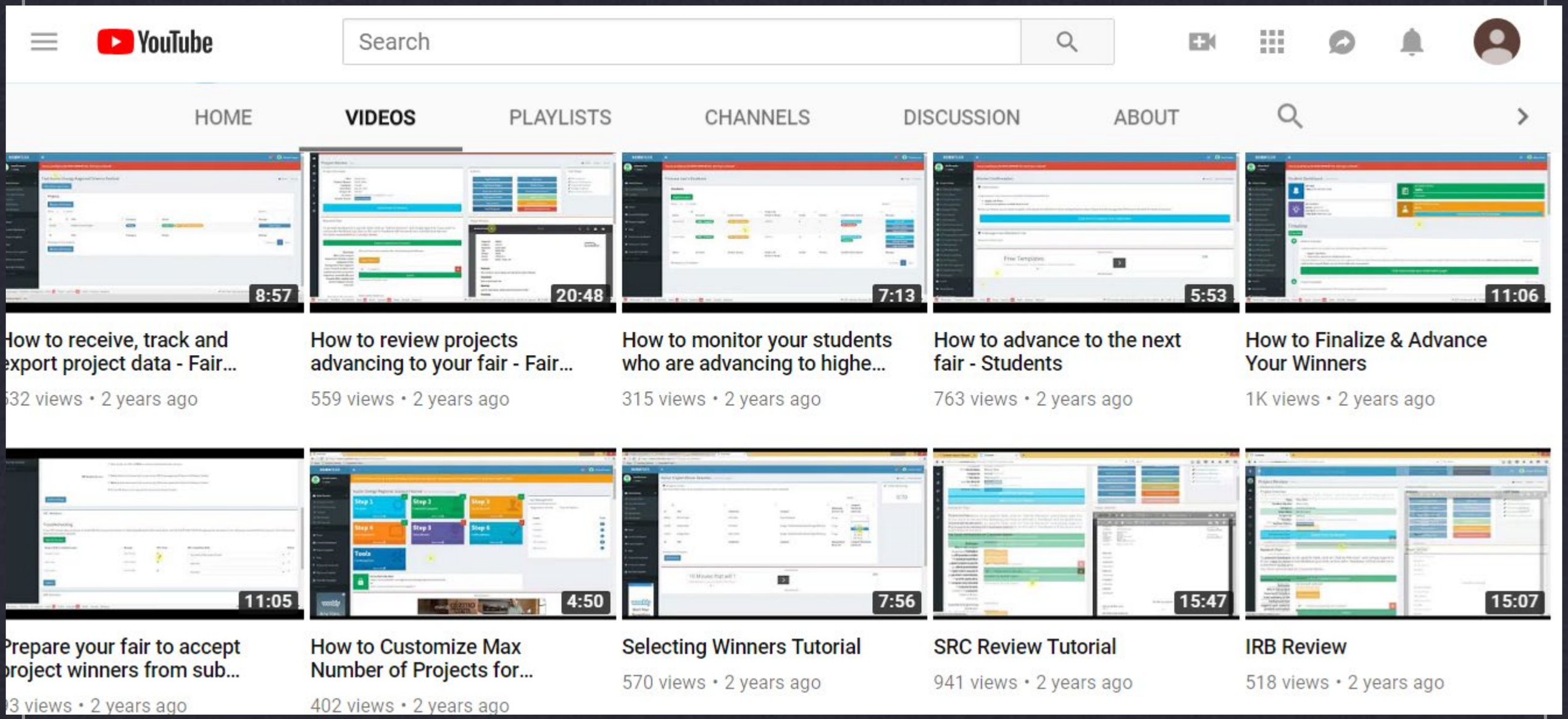
Scienteer Dashboard



Scienteer Help Options



Scienteer Online Tutorials



Some district differences

If you have a district fair, be very conscientious about who is your Administrator! It is important that everyone is a strong communicator.

Districts can:

establish their own categories
share their SRC/IRB with fairs "below" them
set up a little bit of automated messaging for those who advance

Districts may need to set more logistics options:

Ex. fair date, how many can advance to GEARSEF etc based on your district resources

Scienteer - Student Work/Teacher Review

Setting up student accounts

Student project documentation

Teacher review

Practice

Setting Up Student Accounts

1. Once fair is opened, teachers send registration link to students.

2. Students follow link to set up their account. This requires a student email address and a parent email (these can be the same).

3. Parents get an email from Scienteer to approve student participation.

If parents do NOT have email address:

Click on your student list in Scienteer and look for “Register New Student”. You can manually register a student here, using a printed copy of the parent permission form.

Student Scienteer Steps

1. Students create an account and get parental approval

2. Pick project name, category, and team members

**if students register as an individual - they can't go back and become a team. If they are a team they MUST indicate this in the initial setup of the project so there is only 1 project in Scienteer – even if there are multiple students working in the group.

3. Answer Scienteer survey questions

**Student responses determine which "forms" are needed)

4. Fill out research plan info (teacher reviews and students revise)

Student Scienteer Steps

5. Get signatures for any “extra” forms (SRC & IRB)

6. Teacher approval

7. SRC/IRB approval (if needed)

--- Experimentation is *supposed* to happen here ---

8. Complete remaining parts of research plan (results/conclusions)

9. Write project Abstract – be sure students look at examples of strong Abstracts before they begin writing!

Scienteer - Student Work/Teacher Review

Setting up student accounts

Student project documentation

Teacher review

Practice

Student Project Documents

See examples of completed projects

a. Middle School Weak/Strong Packet

b. High School Weak/Strong Packet

Breakout Session

CASIC Tour with T. Speir

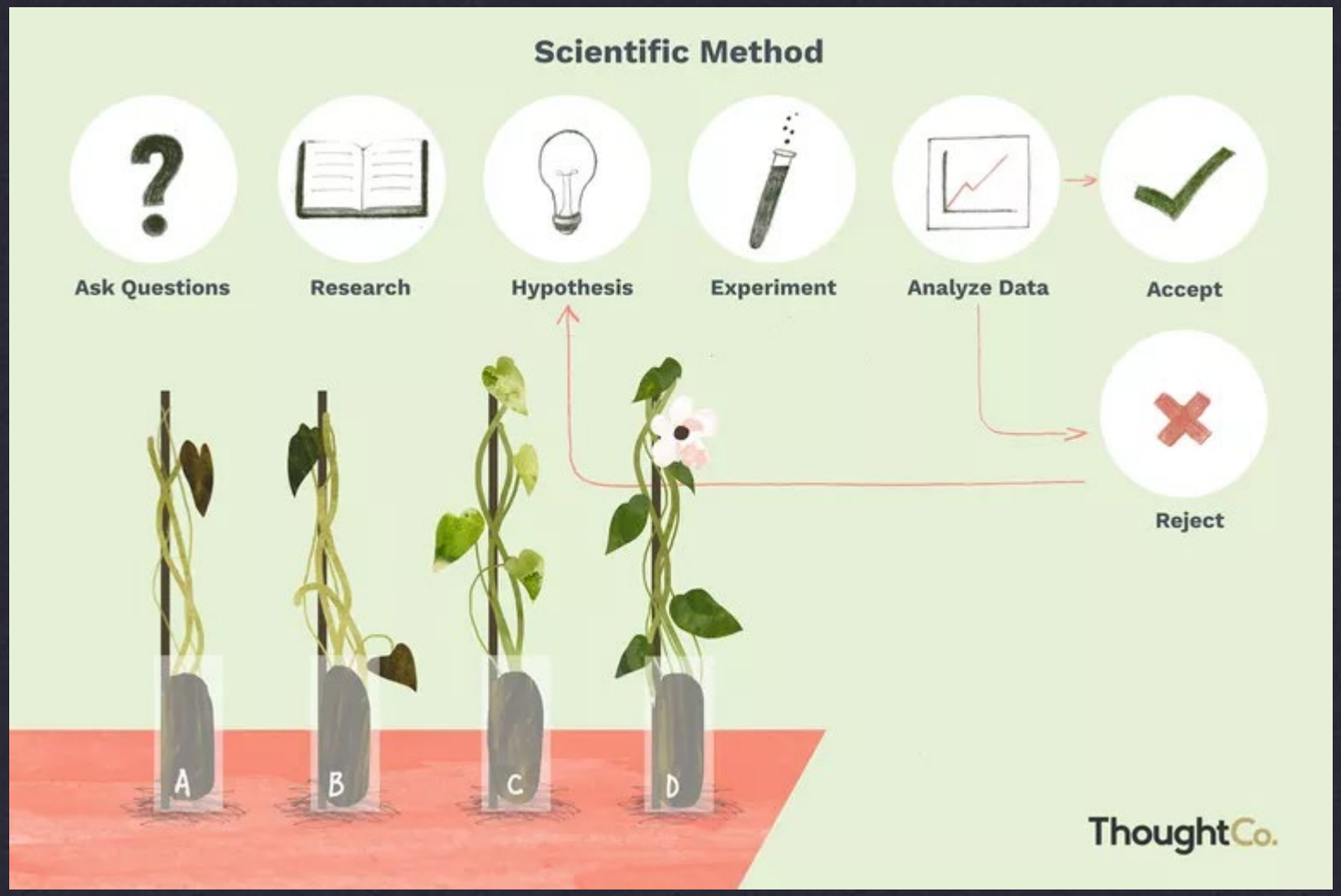
Scienteer - Student Work/Teacher Review

Setting up student accounts

Student project documentation

Teacher review

Project Review: What to watch out for



https://www.thoughtco.com/steps-of-the-scientific-method-p2-606045

Teacher Review

There are a variety of ways to do this:

Scenario 1: More common when managing large numbers of students

All students complete the Front Loading Worksheet Word Doc on paper/digitally (see handout) as an ongoing Homework Assignment (Google Classroom, Schoology etc). Teachers can provide feedback BEFORE students ever begin in Scienteer . If this is done digitally, they can literally cut and paste into Scienteer questionnaire text boxes.

Scenario 2: More common when managing smaller numbers of students

Students develop their project idea, login to Scienteer and begin answer online Questionnaire. Teachers can login and give feedback to students throughout the process directly in Scienteer . Students are responsible for editing on their own.

Front Loading Worksheet

Incredibly helpful in:

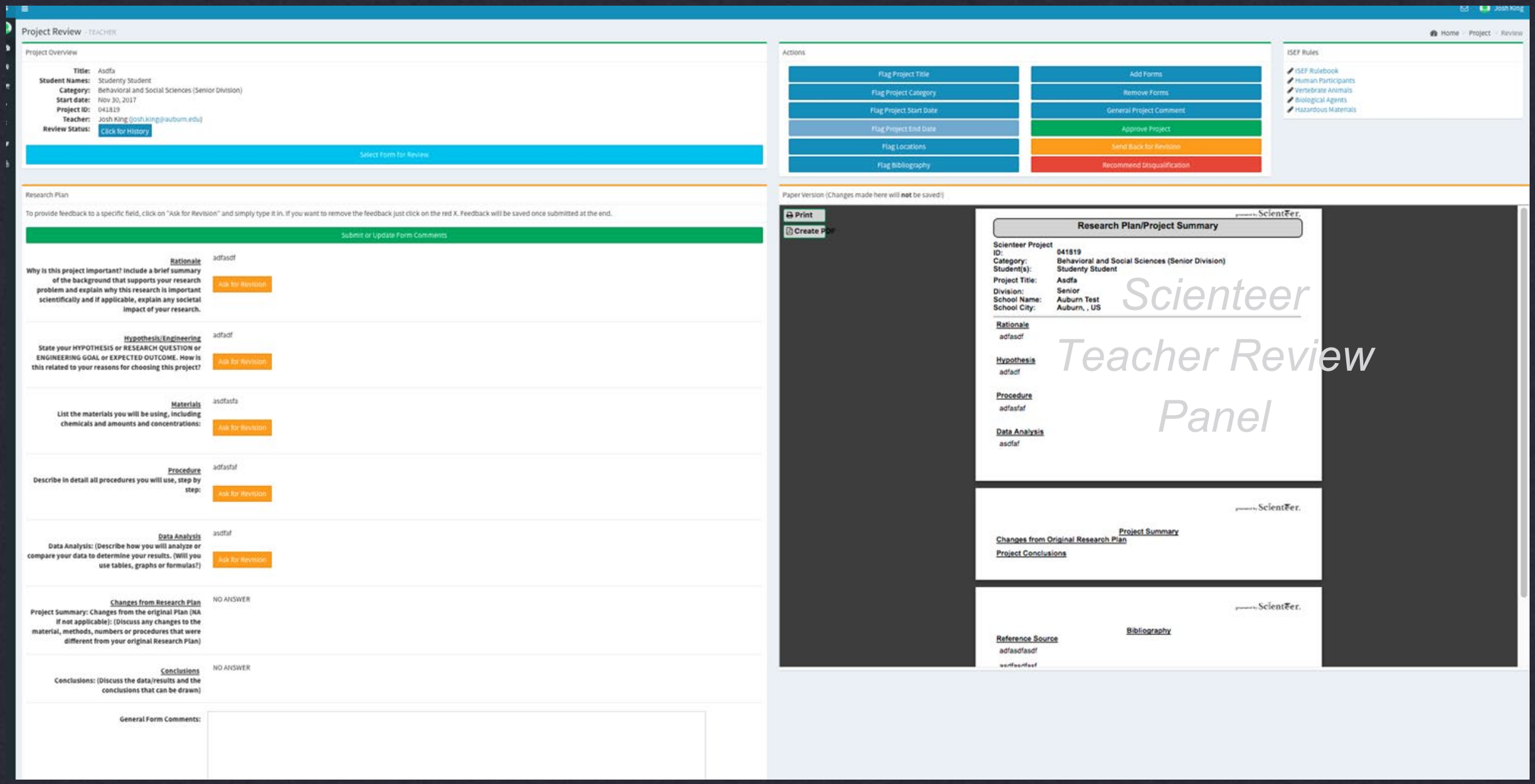
- ✔ gauging their initial plans

- ✔ making sure they answer the survey questions accurately

- ✔ peer review of procedure to ensure it is reproducible

- ✔ cutting and pasting into final research plan they share with SRC/IRB etc

Scienteer Teacher Review



Link for Scienteer tutorials:

https://www.youtube.com/channel/UCVTxFjx7pjafvvRL2SYiGqg

Scienteer resources on GEARSEF website:

http://www.auburn.edu/cosam//departments/outreach/programs/gearsef/scienteer -help.htm

[redacted]
Online

STUDENT MENU

- Project Steps
  - 1: Title and Category
  - 2: Team Status
  - 3: Project Start Date
  - 4: Survey Questions
  - 5: Research Plan
  - 6: Extra Forms
  - 7: Bibliography
  - 8: Research Locations
  - 9: External Signatures
  - 10: Project Approval Method
  - 11: Teacher Approval
  - 12: IRB Approval
  - 13: SRC Approval
  - 14: Project End Date
  - 15: 1C Signature
  - 16: SRC Post-approval
  - 17: Project Summary
  - 18: Abstract
- Filled Forms
- Attachments
- Review History

NAVIGATION

Student Dashboard - SCIENTEER

MY FAIR
FAIR: GREATER EAST ALABAMA REGIONAL SCIENCE AND ENGINEERING FAIR

MY SCHOOL
NAME: CARROLL HIGH SCHOOL
DISTRICT: OZARK CITY SCHOOLS
TEACHER: [redacted]

ACCOUNT STATUS
100%
Complete!

PROJECT COMPLETION
100 %
Complete: SRC Fair Approved

Timeline

18 Feb 2017

Project Update!

Your project has been reviewed. Your results are below:

- **Review Type:** Src Approval
- **Status:** Approved!

Continue your project's progress by following the links in the Project Completion box above!

13 Feb 2017

Project Update!

Your project has been reviewed. Your results are below:

- **Review Type:** Src Approval
- **Status:** Needs Revision

Continue your project's progress by following the links in the Project Completion box above!

09 Feb 2017

Carroll High School Results

Congratulations! Your project has achieved the following at Carroll High School Senior division.

Common Scienteer Issues

No email address - Teachers may have to register manually if just no parent email.

Incomplete Location Address - Needs street address, city & zip

Parent didn't get approval email - Have parents check SPAM folder or you use manual registration option

Account disappears - Students whose parents don't approve will have their account auto-deleted after a couple weeks.

Students sign for themselves as parents -> Tell them not to! This happens when using same email for student account and parent approval.

Projects vs Demons

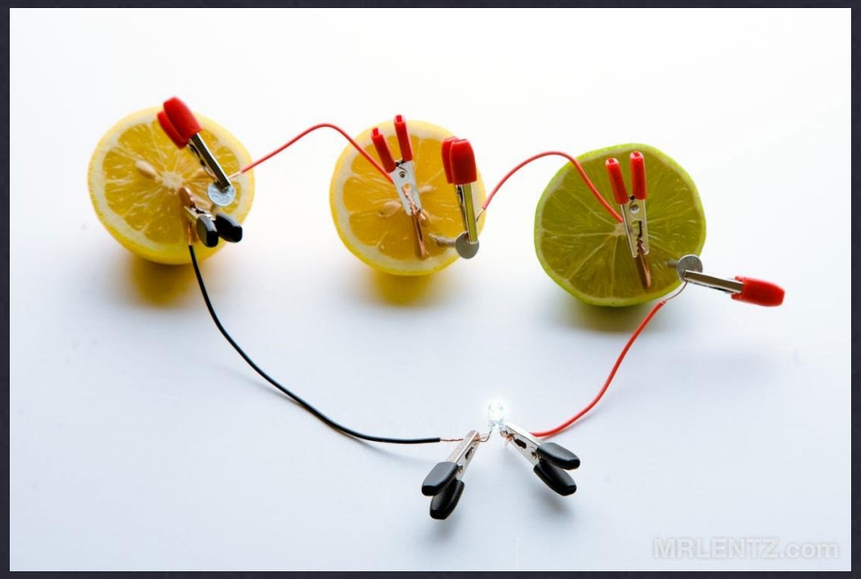
Projects – usually fall into two categories

Science projects - answer a question

Engineering projects - develop a solution to problem

Demonstrations - use science or engineering principles to show an idea

**Demonstrations can be turned into experiments / projects by changing variables, comparing results, and creating new scenarios



https://www.sciencebuddies.org/teacher-resources/lesson-plans/scientific-method-rockets?from=Newsletter

What to do when...

Answer survey questions wrong -> Leads to wrong forms generated. Teacher/GEARSEF can add/remove forms as needed.

Re-answer survey questions -> This will delete any form signatures they have but will keep other data.

Terrible research plans -> They tend to respond in really short and choppy sentences or “texting phrases/shortcuts”. Answers should be written in formal sentences. We need to know EXACTLY what they did! The procedure should be reproducible. Teachers may require them write ahead of time and just cut/paste.

What to do when....

Waiting to get signatures after experimentation -> Be careful! Some signers are not comfortable with "back dating."

Not addressing revision requests -> If teacher/SRC/IRB/GEARSEF makes a revision request, students are notified in the project review history. If they open it to see what changes are being requested, they can accidentally "re-submit" that section to make the flag go away without actually changing it. This defeats the point. Failure to correct some revisions may result in disqualification from competing.

What to look for:

Topic Selection :

Is it a project or demonstration? Is there a testable question? Why is this question important? How is this information useful? What is already known about this topic?

Hypothesis:

Is it testable? If...then statement will usually work as long as the statement is specific.
Is the data needed to answer the question actually measurable?

Research Plan:

Is it safe and ethical?
Is it one of the “tricky” projects (is extra help needed?)
Can someone determine exactly what the student wants to do?
Is data being collected that answers the question?

What to look for:

Data Analysis:

Do the tables/charts/graphs reflect the data correctly?
Is statistical analysis needed? Was it done correctly (error bars, standard deviation etc)
Are there replicates (more than one attempt) to paint an accurate picture of what's going on?

Results/Conclusions:

Did the data support the hypothesis?

Abstract:

Does the abstract contain all of the required elements?

Safety and ethics

Safety Reminders

- Not all household chemicals are safe! (Vinegar + Bleach = Toxic Chlorine gas!)
- Just because it's in the garage doesn't mean it's safe! (Power tools, firearms, etc.)
- Swabbing plates can lead to unknown bacteria growth!
- Protect yourself and your students! (Don't get sued)
- Remember MSDS sheets (for chemicals)
- When in doubt - add that Form 3! (Risk evaluation sheet forces them to think about associated risks)

Ethics Reminders

- Privacy is key and part why any surveys immediately bring in an IRB
- Don't introduce anything to the environment that wasn't there (chemicals, animals, etc.)
- Vertebrate animal regulations are extremely, extremely strict
- When in doubt, bring in the committee/expertise