Name: **Date:** **Section:**

Chi-Square Activity: Statistical Analysis in Biology

Do Genetics Follow Patterns? Let's Find Out! 🧬

Phase 1: ENGAGE (5 minutes)

Getting Started:

Open peebedu.com and navigate to Chi-Square Test Practice

Read the introduction - it's like a detective tool for genetics!

The Mystery:

Imagine you're breeding puppies. You expect 3 brown puppies for every 1 white puppy. But you get 28 brown and 12 white. Is this close enough to 3:1, or is something weird happening?

_____

Your First Guess:

28 brown : 12 white compared to expected 30:10

This seems:

Cool Fact:

Scientists use a special test (chi-square) to solve mysteries like this!

Phase 2: EXPLORE (18 minutes)

Mission 1: Mystery Data! 🤔

The simulation shows you some genetic data.

Observe Your Data:

- What are you counting? _____

Pattern Check:

- What ratio should it be? _____
- Does it look close? Circle: YES / NO

Test It:

1. Enter the expected numbers when asked
2. Watch the chi-square magic happen!
3. Record your results

Results:

- The chi-square number: _____
- What does the simulation say? ACCEPT / REJECT

What This Means:

- ACCEPT = The pattern matches! ✓
- REJECT = Something's different! 🤔

Mission 2: Try Another One! 🎇

Click "New Problem" or choose a different scenario.

Quick Recording:

------- _____ _____ _____

Pattern Detective:

Look at your results above:

- When chi-square is SMALL, we usually: _____

- The test tells us if data _____ the pattern

Mission 3: Challenge Round! 🏆

Keep trying different problems.

Your Goal:

Find one that:

1. Gets ACCEPTED: _____

Think About It:

What makes data "pass" or "fail" the test? _____

Phase 3: EXPLAIN (12 minutes)

Understanding the Pattern Test

1. **The Chi-Square Helper:**

Think of chi-square like a "difference detector":

- Small number = Data MATCHES prediction 😊
- Big number = Data DOESN'T match prediction 🤔

1. **Reading Results:**

Draw lines to match:

$\chi^2 = 0.5$ • • Something's different!

$\chi^2 = 15.2$ • • Matches great!

χ^2 = 3.0 • • Pretty close!

1. **Why Patterns Don't Always Match:**

Circle all reasons why genetic ratios might be "off":

- Random chance (like flipping coins)
- Genes are connected
- Environment affects traits
- Mistakes in counting
- Special inheritance patterns

1. **Practice Predictions:**

Without math, predict HIGH or LOW chi-square:

Expected: 50 red, 50 white

Observed: 49 red, 51 white

Chi-square will be: HIGH / LOW

Expected: 50 red, 50 white

Observed: 90 red, 10 white

Chi-square will be: HIGH / LOW

Phase 4: ELABORATE (10 minutes)

Be a Genetics Detective! 🔍

1. **Create Weird Data:**

Make up data that would NOT match a 3:1 ratio:

- Brown mice: _____
- Why is this weird? _____

1. **Solve the Mystery:**

A flower breeder expects equal red and white flowers (1:1).

She gets 80 red and 20 white.

- Will chi-square be high or low? _____

1. **Real-World Connection:**

Scientists studied peppered moths before and after pollution:

- Before: 50% light, 50% dark
- After: 10% light, 90% dark

Draw what happened:

Before: After: _____

[Draw moths] [Draw moths]

Would chi-square be HIGH or LOW when comparing? _____

What caused the change? _____

Simulation Challenge:

Find a scenario in the simulation where the hypothesis is REJECTED.

Which one? _____

Why do you think it failed? _____

Phase 5: EVALUATE (5 minutes)

Show What You Know!

1. **Quick Quiz:**

[ ] Data matches prediction

[ ] Data is totally wrong

[ ] Test is broken

[ ] Need to start over

1. **Think Like a Scientist:**

You breed 100 plants expecting half tall, half short.

You get 48 tall, 52 short.

Is this close enough? YES / NO

Why? _____

1. **Pattern Power:**

Chi-square helps us know if patterns are real or just random.

Give an example of when this would be useful: _____

1. **Big Idea:**

Why can't scientists just look at data and guess if it matches?

Fun Challenge:

If you were studying your class, what genetic trait would you test?

Trait: _____

What pattern would you expect? _____

- --

****Take It Further:****

Try all the scenarios in the simulation. Make a chart showing which ones "passed" (accepted) and which ones "failed" (rejected). Can you find a pattern? _____

Key Vocabulary:

See activity for vocabulary specific to this topic.