Authentic Assessments in the Middle School Science Classroom

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Glenrock Ju

Demographics

- Town Populatic 2,500
- Grades 7-12, Enrollment: 30
- Energy and agriculture-bas economy

- New administration 2018-19
- Goals: Increase graduation rate (recently improved from 81.8%-92.3%)
- Increase average ACT score

Do Wyoming kids actually ride horses to school?

Context: Why authentic assessment?

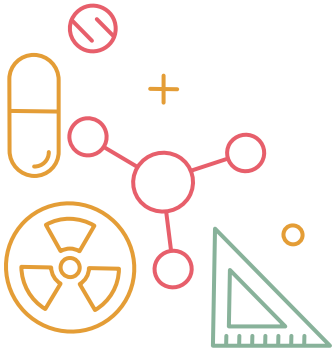
In my Classroom		
• Lack of buy-in and motivation for traditional academics • Do traditional exams work for every student? • Some thrive with non-traditional opportunities	• Lose confidence and motivation if not successful with traditional academics • Different learning styles = differentiate instruction • Differentiate assessment?	• Students more engaged in authentic assessment • Traditional assessments = negative mind set and anxiety.

Overheard in the Classroom

Before traditional tests:	“I’m going to fail.”	“I’m very scared.”
“I’m scared for this test if I’m being honest.”	“I’m having really bad anxiety and panicking.”	“You don’t know how nervous I am about this test”

Context

Why authentic assessment?



Allow students to show their understanding of the content and utilize individual strengths.

Give students autonomy and opportunity to be successful and gain confidence

Choice-based authentic summative assessments

Focus Questions

Main Question	Sub-Question 1	Sub-Question 2	Sub-Question 3
Does offering choice-based alternative assessments in place of traditional assessments increase student achievement in the science classroom?	Do choice-based alternative assessments increase student engagement in the assessment process?	Will offering students choice on assessments improve student confidence?	Will offering students choice-based alternative assessments decrease test anxiety?

What is authentic assessment?

One size of assessment does not fit all

Conceptual Framework

- A way to gauge student mastery in a more authentic way.
- Constructivist pedagogy = actively constructing knowledge
- Assess application not memory

- Self-determination theory = empowering students need for autonomy
- Enhance competence, have value, engage interests
- Not too much choice

- Glasser's choice theory: power, fun, freedom
- Multiple intelligences and learning styles
- Capture students unique abilities = differentiation
- 21st century skills

Methodology

Classroom Demographics

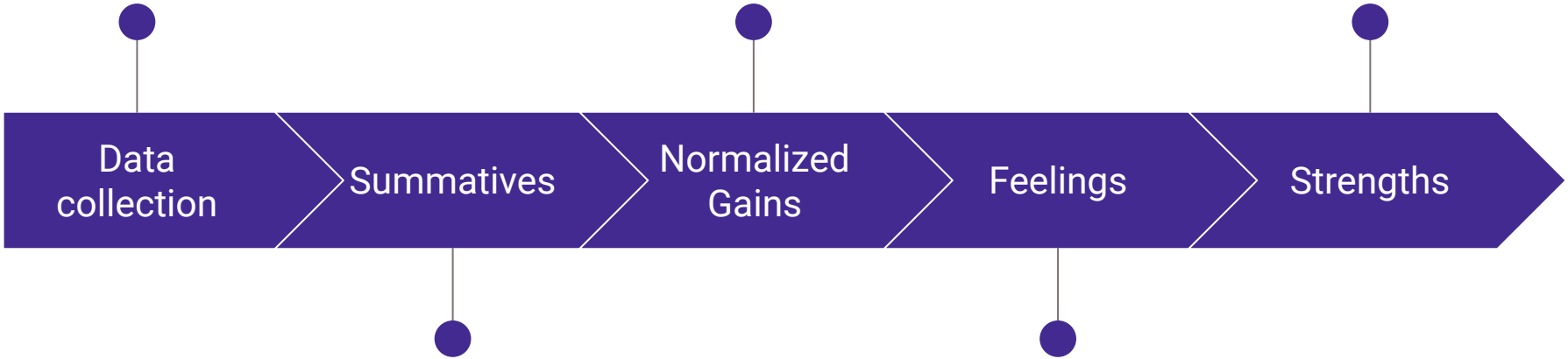
- Three 8th-grade physical science classes. Fall 2020-Spring 2021
- 16-21 students in each class
- 45 total students
- 9 IEP, 2 504, 1 ELL
- 60% female, 40% male

Treatment

4 units of study

Pre-tests before each unit.

Learning styles assessment



Alternated between traditional and alternative assessment with choice

Survey before each assessment, interviews, observations

Interactions of Matter Summative Project (50 pts)

Project Options: You may choose to present the required content in one of the following ways:

- Scrapbook or Poster (Poster board, or trifold)
- Journal Entries (Written like first hand accounts of experiencing the information)
- Create a review game
- Present content as related to a real world topic or interest (see example)
- Video demonstration (Example: demonstrating a physical and chemical change, describing the components as you do the experiments to meet the requirements)
- You may come up with your own creative project, just get Ms. Huntington's approval

Chemical Bonding Alternative Assessment (50 pts)

This project is designed to let you demonstrate your knowledge of chemical bonding in a way that you choose.

My Choice: Please choose one of the following methods of presenting the required information:

- **Children's story, graphic novel, or comic book:** Storybooks and comic books should tell a story, have characters, and a central theme. For the storybook, one picture is required per page. The comic strip will have more pictures. Both should be submitted on 8 ½ x 11 paper. Story and comic books should be free of spelling and grammar errors.

- **Skit:** Write and perform a skit (either for the class or for just Ms. Huntington) that meets the information requirements in a creative way. Props should be created and used in the performance. I.E. Valence electrons may be balls, each person may be an atom with a sign to wear representing that atom's symbol …

- **Model/Poster:** Models/posters/displays should show all required information in a CREATIVE way and include pictures and diagrams. Display should be free of spelling and grammar errors.

- **Song/Rap:** Songs or Raps should be creative in nature. DO NOT just sing/rap definitions and explanations. Songs should have a melody (either unique or based on the melody of an existing song). Raps should have a pattern or rhythm. Song or Rap must be a minimum of 2 minutes in length but should not exceed 5 minutes. You may present it live, or record it and turn it in.

Interactions of Matter Project Scoring Rubric

Component	Target	Exceptional	Proficient	Developing	Not Yet
Physical and Chemical Properties (10 pts)	❑ Physical and Chemical Properties Defined (2 pts) ❑ 3 substances and 3 physical properties of each properly described (6 pts) ❑ 2 substances and 1 chemical property of each described (2 pts)	10-9 All required components are correctly presented. Proper vocabulary is used.	8-7 Missing or partially formed elements. (2-3) 2-3 Elements missing or misrepresented.	6-5 Missing or partially formed elements (4-5) 4-5 elements missing or misrepresented.	4-0 Missing more than 5 elements. Targets largely ignored.
Physical and Chemical Changes (10 pts)	❑ Physical and Chemical changes defined (2 pts) ❑ 2 Examples of physical changes properly described (2 pts) ❑ 2 examples of chemical changes properly described with signs explained (4 pts) ❑ Temperature and reaction rate or insulation described (2 pts)	10-9 All required components are correctly presented. Proper vocabulary is used.	8-7 Missing or partially formed elements. (2-3) 2-3 Elements missing or misrepresented	6-5 Missing or partially formed elements (4-5) 4-5 elements missing or misrepresented.	4-0 Missing more than 5 elements. Targets largely ignored.
States of Matter (10 pts)	❑ States of matter and how the molecules behave described (3 pts) ❑ Kinetic theory of matter stated (1 pt) ❑ How substances change state properly explained with examples if each state change (6 pts)	10-9 All required components are correctly presented. Proper vocabulary is used.	8-7 Missing or partially formed elements. (2-3) 2-3 Elements missing or misrepresented	6-5 Missing or partially formed elements (4-5) 4-5 elements missing or misrepresented.	4-0 Missing more than 5 elements. Targets largely ignored.
Classifying Matter (10 pts)	❑ Elements, compounds, mixtures defined with examples (4 pts) ❑ Pure substances, heterogenous, homogenous mixtures defined with examples (3 pts) ❑ Suspensions, solutions, colloids defined with examples (3 pts)	10-9 All required components are correctly presented. Proper vocabulary is used.	8-7 Missing or partially formed elements. (2-3) 2-3 Elements missing or misrepresented	6-5 Missing or partially formed elements (4-5) 4-5 elements missing or misrepresented	4-0 Missing more than 5 elements. Targets largely ignored.
Quality and Effort (10 pts)		10-9 Project is creative, organized, and neatly done to the best of your ability. No grammar or spelling errors. Best effort is shown.	8-7 Project is creative and neatly done to the best of your ability. It is mostly organized. Few grammar and spelling errors. Effort is mostly there.	6-5 More creativity could be applied. Project is somewhat sloppy and unorganized. Grammar and spelling errors occur throughout. Effort could improve.	4-0 Project is incomplete and lacks focus and creativity. Many grammar and spelling errors present. Little to no effort put in.
BONUS	❑ Law of conservation of mass explained with an example (2 pts)				

Total: _____/50

NOTES:

Chemical Bonding Project Scoring Rubric

Component	Target	Exceptional	Proficient	Developing	Not Yet
Chemical Bonding Basics (6 pts)	❑ Valence electrons and their role are explained or demonstrated. (2 pts) ❑ The Octet Rule and why atoms bond is explained or demonstrated. (2pts) ❑ Noble gasses are defined, and an example is provided. (2pts)	6-5 All required components are correctly presented. Proper vocabulary is used.	4-3 Missing or partially formed elements. (2-3) 2-3 Elements missing or misrepresented.	3-2 Missing or partially formed elements (4-5) 4-5 elements missing or misrepresented.	1-0 Missing more than 5 elements. Targets largely ignored.
Ionic Bonds (15 pts)	❑ At least 2 properties are included. (3 pts) ❑ Types of atoms that form the bonds correctly explained or shown. (3pts) ❑ What happens to the electrons is correctly explained or shown. (3pts) ❑ How the atoms come together is explained or demonstrated. (3pts) ❑ Anion and Cation are terms used to explain ions. (1pt) ❑ At least one example is correctly explained, diagramed, or demonstrated. (2pt)	15-14 All required components are correctly presented. Proper vocabulary is used.	13-12 Missing or partially formed elements. (2-3) 2-3 Elements missing or misrepresented	11-9 Missing or partially formed elements (4-5) 4-5 elements missing or misrepresented.	8-0 Missing more than 5 elements. Targets largely ignored.
Covalent Bonds (15 pts)	❑ At least 2 properties are included. (3pts) ❑ Types of atoms that form the bonds are correctly explained or shown. (3pts) ❑ What happens to the electrons is correctly explained or shown (3pts) ❑ Single, double, and triple bonds are explained or demonstrated correctly. (3pts) ❑ At least one example is correctly explained, diagramed, or demonstrated. (3pts)	15-14 All required components are correctly presented. Proper vocabulary is used.	13-12 Missing or partially formed elements. (2-3) 2-3 Elements missing or misrepresented	11-9 Missing or partially formed elements (4-5) 4-5 elements missing or misrepresented.	8-0 Missing more than 5 elements. Targets largely ignored.
Metallic Bonds (4 pts)	❑ At least 2 properties are included. (1pt) ❑ Types of atoms that form metallic bonds are correctly explained or shown. (1pt) ❑ What happens to the electrons is correctly explained or shown. (1pt) ❑ At least one example is correctly explained or demonstrated. (1pt)	4 All required components are correctly presented. Proper vocabulary is used.	3 Missing or partially formed elements. (2-3) 2-3 Elements missing or misrepresented	2 Missing or partially formed elements (4-5) 4-5 elements missing or misrepresented	1-0 Missing more than 5 elements. Targets largely ignored.
Quality, Creativity and Effort (10 pts)	❑ Little to no spelling or grammatical errors. ❑ Project is creative and genuine. ❑ Project is visually pleasing. ❑ Specific project type requirements are met.	10-9 Project is creative, organized, and neatly done to the best of your ability. No grammar or spelling errors. Best effort is shown.	8-7 Project is creative and neatly done to the best of your ability. It is mostly organized. Few grammar and spelling errors. Effort is mostly there.	6-5 More creativity could be applied. Project is somewhat sloppy and unorganized. Grammar and spelling errors occur throughout. Effort could improve.	4-0 Project is incomplete and lacks focus and creativity. Many grammar and spelling errors present. Little to no effort put in.

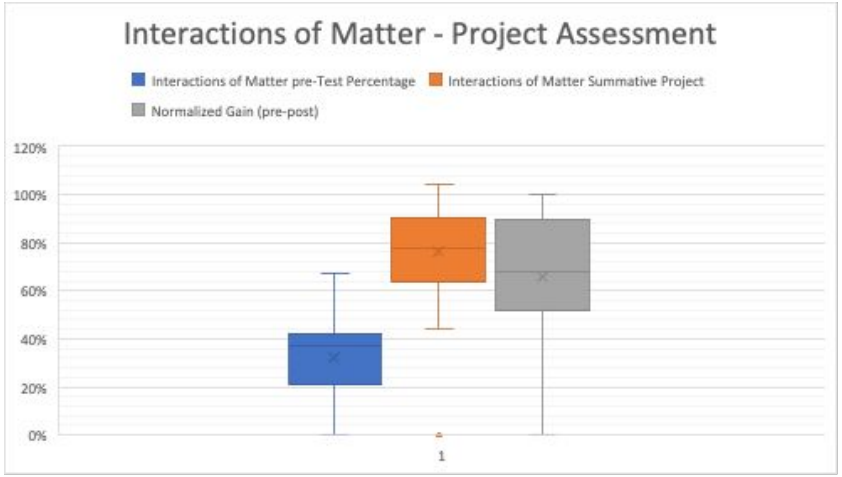
Total: _____/50

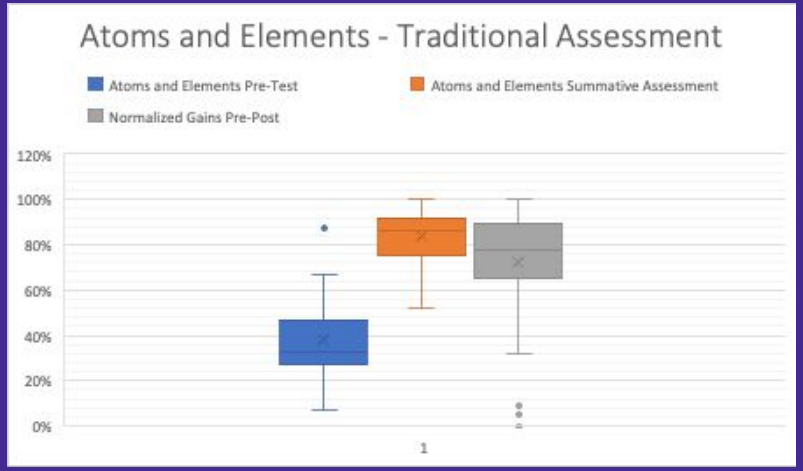
NOTES:

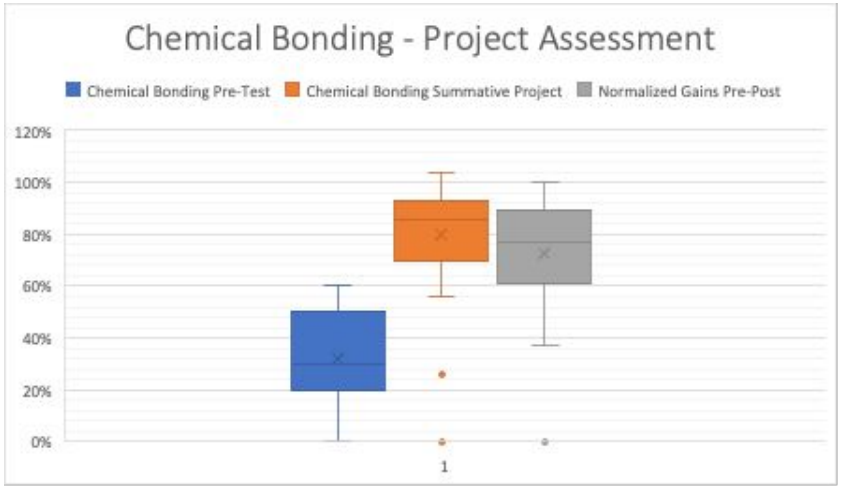
Rubrics

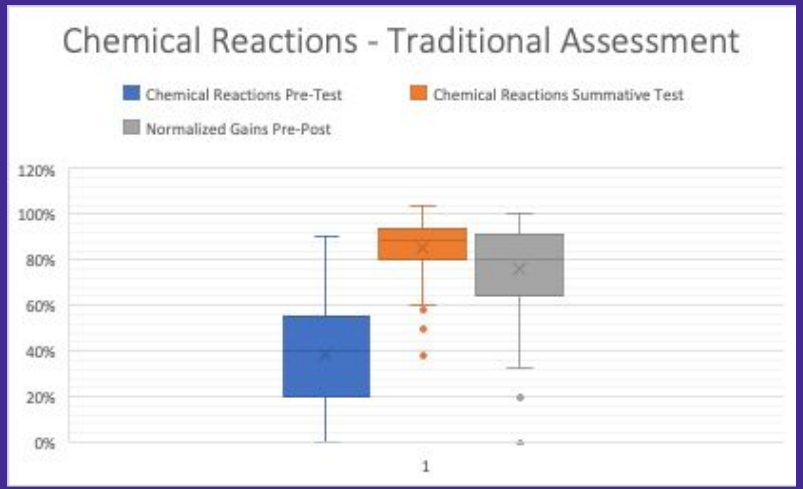
Data Analysis

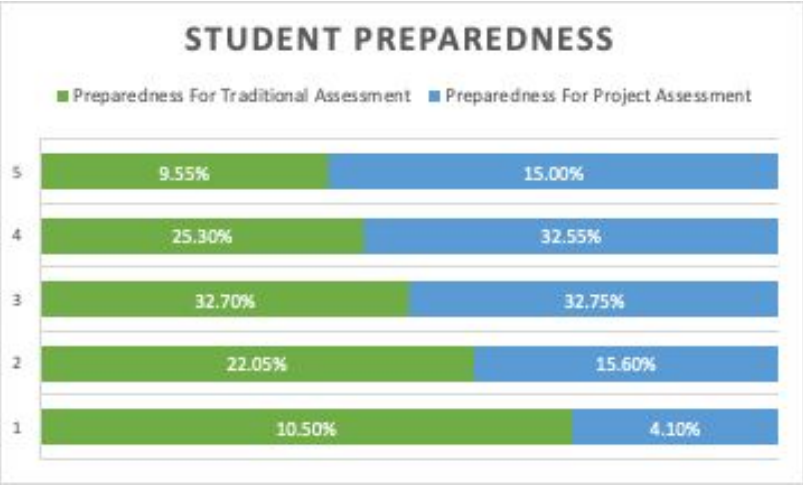
Results

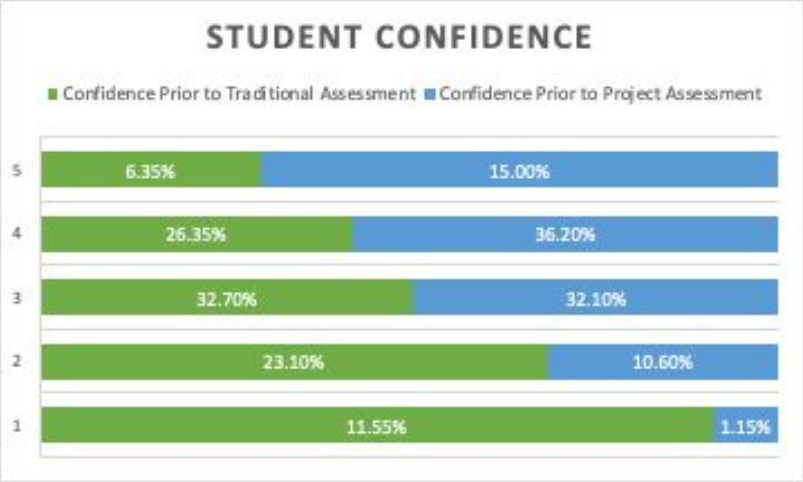

Interactions of Matter - Project Assessment
Interactions of Matter pre-Test Percentage
Interactions of Matter Summative Project
Normalized Gain (pre-post)
120%
100%
80%
60%
40%
20%
0%
1

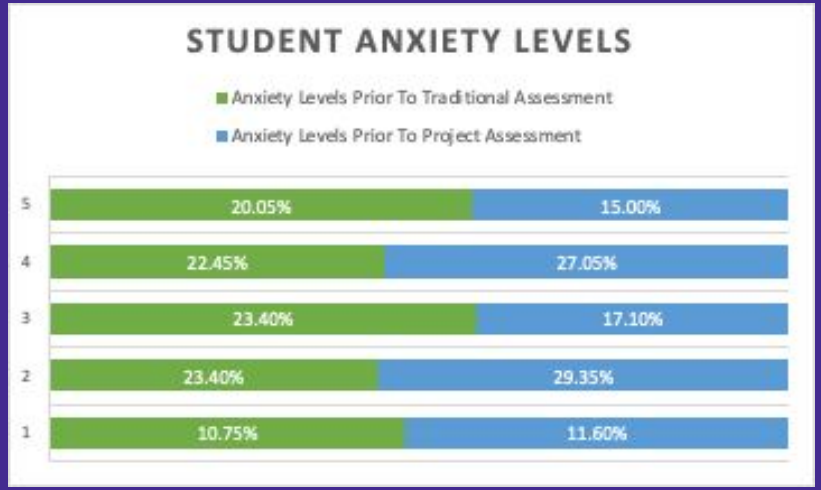

Atoms and Elements - Traditional Assessment
Atoms and Elements Pre-Test
Atoms and Elements Summative Assessment
Normalized Gains Pre-Post
120%
100%
80%
60%
40%
20%
0%
1


Chemical Bonding - Project Assessment
Chemical Bonding Pre-Test
Chemical Bonding Summative Project
Normalized Gains Pre-Post
120%
100%
80%
60%
40%
20%
0%
1


Chemical Reactions - Traditional Assessment
Chemical Reactions Pre-Test
Chemical Reactions Summative Test
Normalized Gains Pre-Post
120%
100%
80%
60%
40%
20%
0%
1

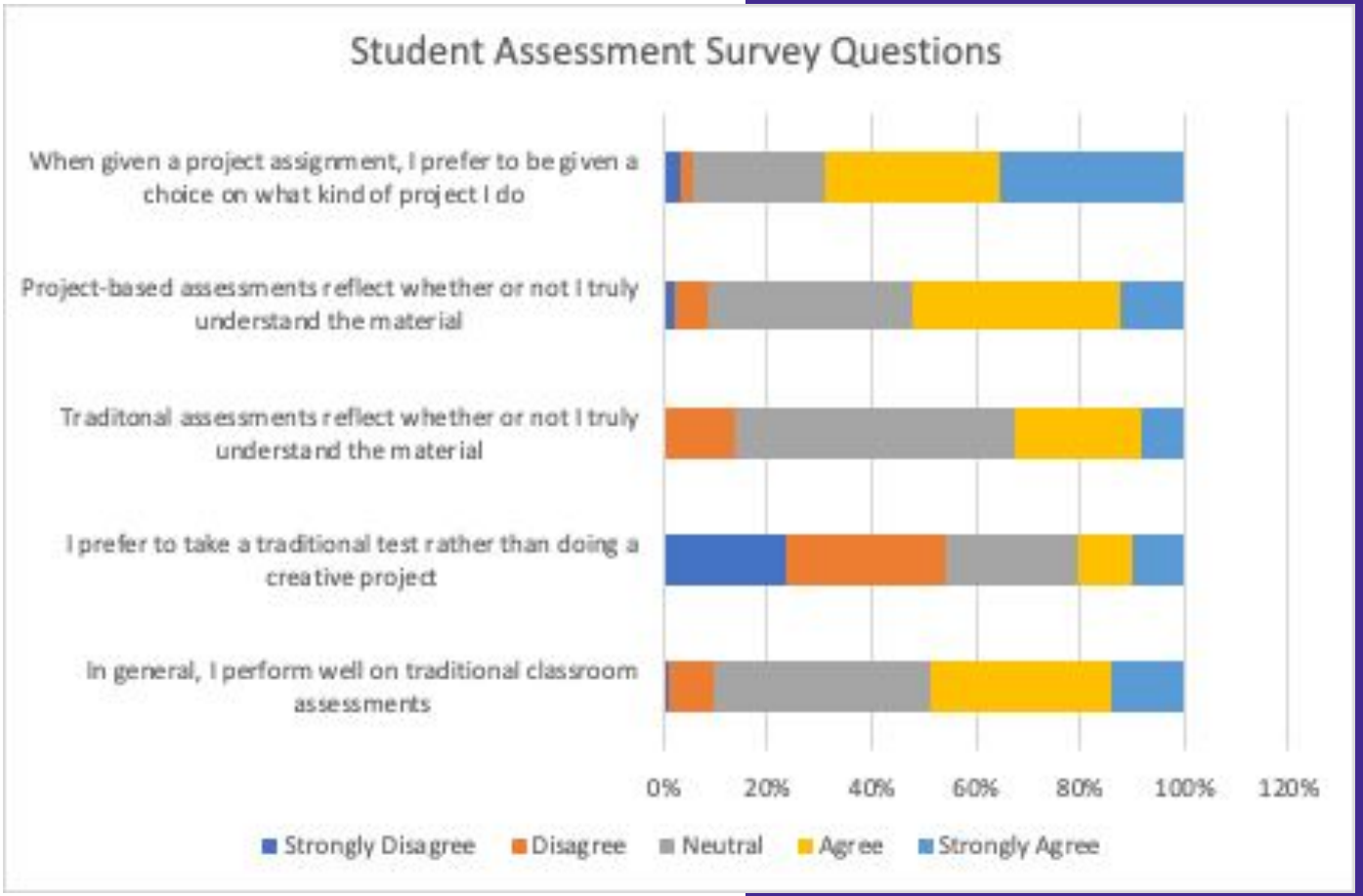






"I'm worried that I won't do well on a regular test but if I study I feel more confident." When asked the same question about projects: "I feel excited because I prefer them."

"I feel stressed before a project because I always feel like I'm not going to finish in time and that makes me nervous, also on projects you never really have a definite answer which makes it difficult."


Student Assessment Survey Questions
When given a project assignment, I prefer to be given a choice on what kind of project I do
Project-based assessments reflect whether or not I truly understand the material
Traditonal assessments reflect whether or not I truly understand the material
I prefer to take a traditional test rather than doing a creative project
In general, I perform well on traditional classroom assessments
0%
20%
40%
60%
80%
100%
120%
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

Learning Style Assessment

Learning Style Assessment

Read each statement and select the appropriate number response as it applies to you.

Often (3) Sometimes (2) Seldom Never (1)

Visual Modality

____ I remember information better if I write it down.
____ Looking at the person helps keep me focused
____ I need a quiet place to get my work done.
____ When I take a test, I can see the textbook page in my head.
____ I need to write down directions, not just take them verbally.
____ Music or background noise distracts my attention from the task at hand.
____ I don't always get the meaning of a joke.
____ I doodle and draw pictures on the margin of my notebook page.
____ I have trouble following lectures.
____ I react very strongly to colors.
____ Total

Auditory Modality

____ My papers and notebooks always seem messy.
____ When I read, I need to use my index finger to track my place on the line.
____ I do not follow written directions well.
____ If I hear something, I will remember it.
____ Writing has always been difficult for me.
____ I often misread words from the text- (i.e. "them" for "then").
____ I would rather listen and learn than read and learn.
____ I'm not very good at interpreting an individual's body language.
____ Pages with small print or poor quality copies are difficult for me to read.
____ My eyes tire quickly, even though my vision check-up is always fine.
____ Total

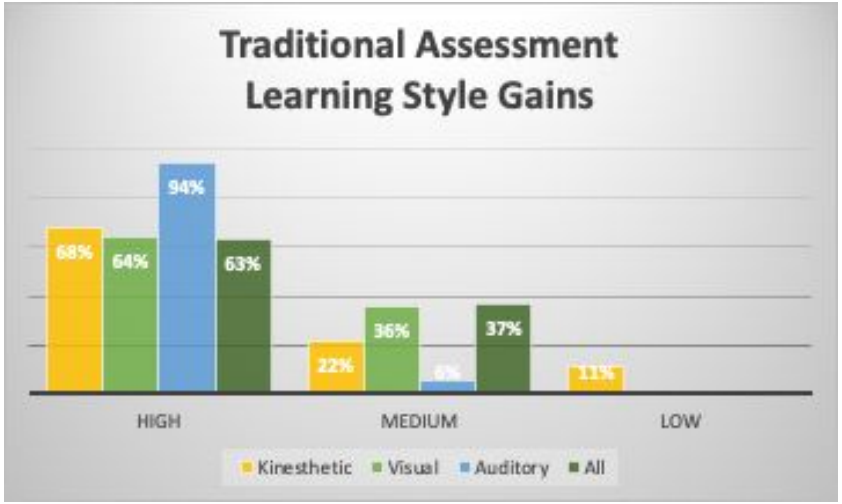
Kinesthetic/Tactile Modality

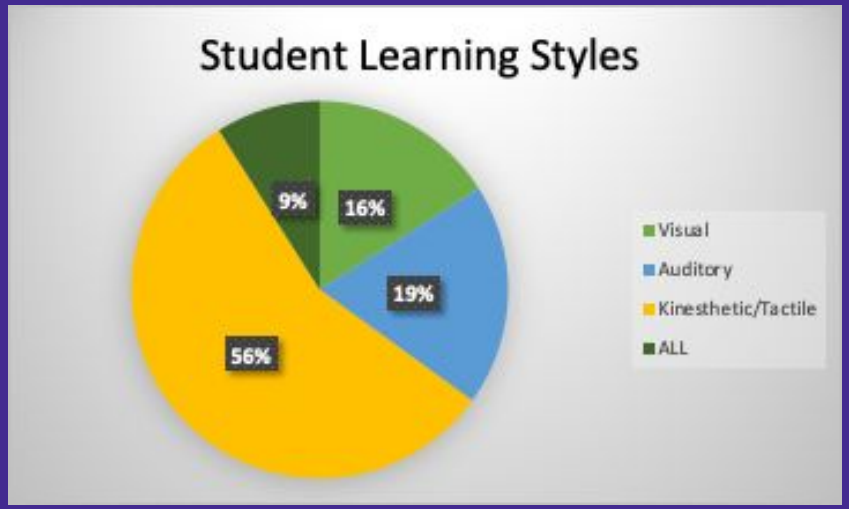
____ I start a project before reading the directions.
____ I hate to sit at a desk for long periods of time.
____ I prefer first to see something done and then to do it myself.
____ I use the trial and error approach to problem-solve.
____ I like to read my textbook while riding an exercise bike.
____ I take frequent study breaks.
____ I have a difficult time giving step-by-step instructions.
____ I enjoy sports and do well at several types of sports.
____ I use my hands when describing things.
____ I have to re-write or type my class notes to reinforce material.
____ Total

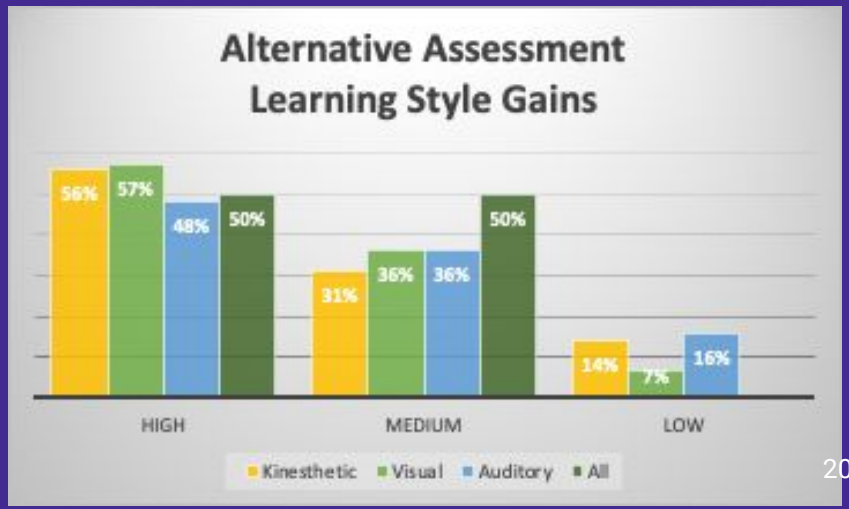
Total the score for each section. A score of 21 points or more in a modality indicates a strength in that area. The highest of the 3 scores indicates the most efficient method of information intake. The second highest score indicates the modality which boosts the primary strength. For example, a score of 23 in visual modality indicates a strong visual learner. Such a learner benefits from the text, from filmstrips, charts, graphs, etc. If the second highest score is auditory, then the individual would benefit from audio tapes, lectures, etc. If you are strong kinesthetically then taking notes and rewriting class notes will reinforce information.

Learning Style Assessment

“I do like to be given the opportunity to choose what kind of project we get to do because I feel like students are stronger in different ways, some may be more on the creative side and some have more of a liking to just write down the information.”







Claims, Evidence, Reasoning

Claims from the study

Student Achievement

- Not significantly different between assessment types.
- Traditional averages: 84% and 85%. Gains: .72 and .76.
- Alternative averages: 76% and 80%. Gains: .66 and .73.

Survey Results

- More confidence and feel more prepared prior to alternative assessment.
- Anxiety is high prior to any assessment.
- Clear preference for alternative assessment and choice

Learning Styles

- Kinesthetic learners
- Auditory learners = higher gains on traditional assessments
- Other learning types = no significant differences
- More data needed

Claims from the study

Student Attitudes

- Formative projects vs. summative
- Prefer to be given the choice to work collaboratively

Student Quotes

- ”I prefer projects because if I am confused, I get to understand it better on a project. On a test, I just would study the stuff and that would make me more confused.”
- “I like [projects] because I can put my understanding in my own words and I am not as stressed.”
- “I am always excited for projects, they are my favorite.”
- “I prefer projects, because you can show what you learned and be creative.”
- “No, not all students can be successful on tests because some people just can’t take in all the information at once.”

Value & Future

- Not all content fits an authentic assessment approach
- Students prefer collaboration which is difficult with summatives.
- Too much content for a project is overwhelming - Different approach – tic-tac-toe, ladder
- Giving feedback throughout the course of creating is helpful for students
- Time Management
- Stress and anxiety management tools
- Connect learning, standards, tests
- Healthy balance

https://drive.google.com/file/d/1czc1uUwcsX_wjXQ4acqFWHDGGD9FEB4b/view?usp=sharing

Fin.

Thank You!