



Performance Assessments, Portfolio Assessments, Rubrics, and STEAM

Chrystine Alhona, Marisa Drogan, Sean McKenna, Tim Paccione | EPSY 605 | Marist College

Introduction

- Topics:
 - Performance Assessments
 - Portfolio Assessments
 - Rubrics
- Classroom:
 - 9th Grade Science, Technology, Engineering, Arts, and Mathematics (STEAM) Class
 - Interdisciplinary classroom setting provides us an opportunity to examine our topics from a complex, unique perspective.

STEAM

Overview and Workshop

What is STEM?

- **STEM:**
 - The idea of educating students in four disciplines, science, technology, engineering and mathematics, through an interdisciplinary approach



Best STEM Assessment Practices

- Performance
- Portfolios
- Rubrics
- STEM to STEAM



Benefits of a STEAM Curriculum

- The curriculum shifts around students' interest, and aims towards topics such as science in society
- Build on experiences and relationships between the individual and community
- Promotes self-reflection, deep engagement and responsibility for students' own learning
- Fosters multiple levels of divergent thinking

E-Portfolios

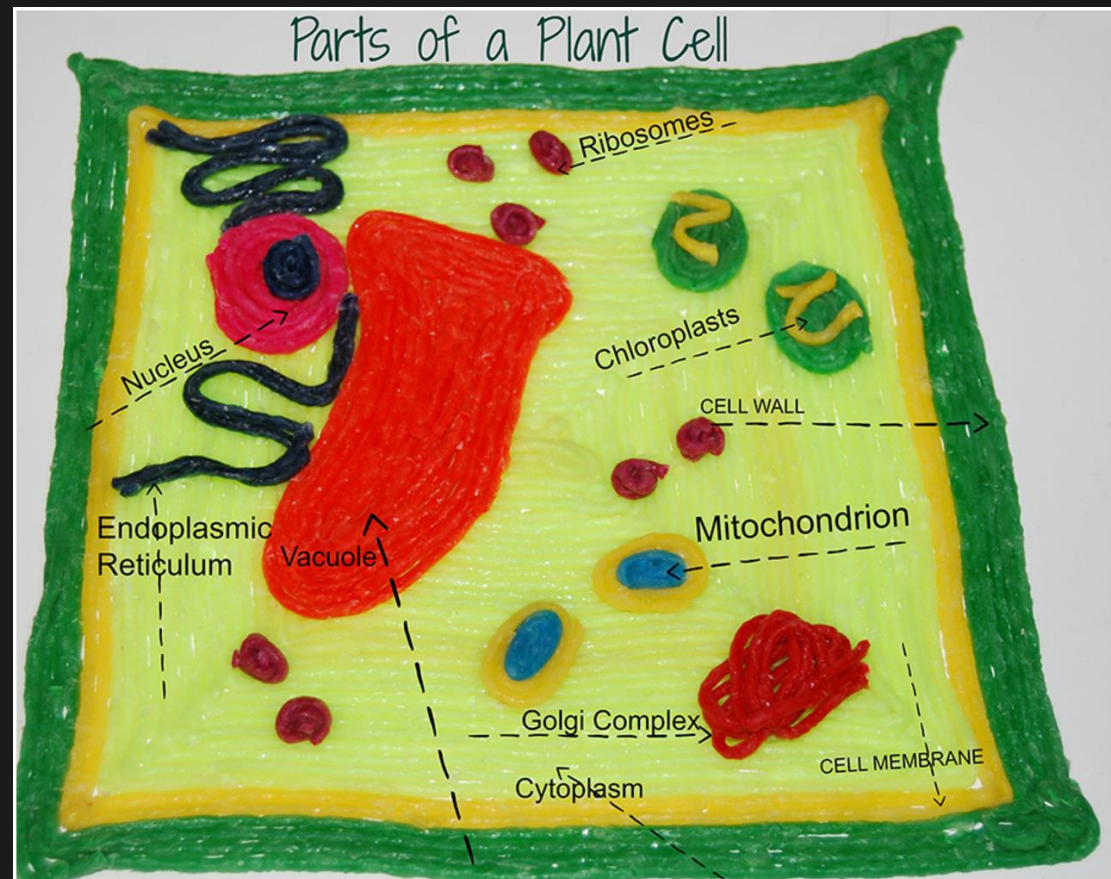
- Hanyang Elementary School, Seoul, Korea
- Implemented a STEAM e-portfolio in the classroom.
- Study showed:
 - Higher level of creative and critical thinking
 - Higher level of enjoyment in the classroom across multiple contents

Rubrics: WHERETO

- **W**: “Where are we going? What is expected?”
- **H**: “How will the students be engaged?”
- **E**: “Students’ expected performance.”
- **R**: “Rethinking, or revise.”
- **E**: “Self-evaluation & reflection of thinking.”
- **T**: “Accommodation of learning styles, interests and needs.”
- **O**: “Organization of assessment and learning.”

Breaking Apart a STEAM Assessment:

- In small groups list the skills that could be assessed in this STEAM Assessment.
 - Science:
 - Technology:
 - Engineering:
 - Arts:
 - Math:
- Be ready to share 😊



Breaking Apart:

- Science: developing and using a model to describe the function of a plant cell
- Technology: using digital technology to research, document learning, and support inquiry.
- Engineering: constructing a 3D model of a plant cell
- Arts: using creative expression to design and develop a cell
- Math: measurement and design of the shapes of organelle

Performance Assessments

Overview and Discussion


Literature Review

- An increase in STEM instruction can lead to an increase in academic performance, catalyzed by an active learning experiences (Freeman, 2014).
- Active learning (learning by doing) can lead to an increase in examination performance and raises students' average grades to a statistically significant degree.
 - Failure rates under traditional lecturing are 55% higher than rates observed under active learning.
- As national and state standards are focusing more and more on authentic learning, exposure to performance assessments is critical to student success (Pandey, 1990).
- Qualitative studies support the transformation of science classrooms into areas where students “do science and develop habits of mind” (Shymansky, 1997).

Performance Assessments vs. Traditional Testing



Louis C.K.: Standardized Tests = BAD!

 **Louis C.K.** @louisck

My kids used to love math. Now it makes them cry. Thanks standardized testing and common core!

RETWEETS 6,339 FAVORITES 8,305

8:00 AM - 28 Apr 2014

 **Louis C.K.** @louisck

Sorry. I sit with my kids as they do their HW they devour knowledge. When it's hard they step up. Their teachers are great

5:43 PM - 28 Apr 2014


376 RETWEETS 850 FAVORITES

 **Louis C.K.** @louisck

But it's changed in recent years. It's all about these tests. It feels like a dark time. And nothing is going in anymore.

5:44 PM - 28 Apr 2014

908 RETWEETS 1,636 FAVORITES

 **Louis C.K.** @louisck

It's this massive stressball that hangs over the whole school. The kids teachers trying to adapt to these badly written notions.

5:46 PM - 28 Apr 2014

762 RETWEETS 1,480 FAVORITES

1)


Part A:

Fill in the blanks below with whole numbers greater than 1 that will make the number sentences true.

1. $63 \div \underline{\quad} = 7$
2. $63 = 21 \times \underline{\quad}$
3. $21 = \underline{\quad} \times 7$
4. $7 \times (\underline{\quad} \times \underline{\quad}) = 21 \times 7$ 5. $(21 \times 3) \div \underline{\quad} = 7$

Part B:

If the product of two whole numbers greater than 1 is 63, what could the two whole numbers be? ,

 **Louis C.K.** @louisck

Look at 4 of part a. And the point isn't that it's too hard. Just read #4. Please.

4:47 PM - 28 Apr 2014

710 RETWEETS 1,433 FAVORITES

Counterpoint: Standardized Tests are Good!



JAMES AYCOCK

James Aycock is currently the Director of Scholar Support at

Grizzlies Prep, an all-boys public charter middle school located in downtown Memphis. He previously served as the founding Special Education Coordinator with Tennessee's Achievement School District, after several years as a special educator and baseball coach at Westside Middle School in the Frayser community of North Memphis.

So Are Standardized Tests Good or Bad?



- Questions for Discussion:
 - Who do you agree with and why?
 - What do you feel makes an assessment good or bad?
 - What role can performance assessments play in the development of “good tests”?



VS.



Portfolio Assessments

Overview and Activity

Literature Review

- Portfolios can serve a powerful purpose in all content areas, including STEM.
- It is important that teachers facilitate the content of the portfolio to reflect the standards and learning objectives they teach (Whitworth, 2013).
- When properly implemented, portfolios allow students to reflect on their course work and guide their future goals (Cruz, 2013).
- Working with students in creating their portfolios provides teachers with an opportunity to improve communication and understanding of their students (Kim, 2014).

Portfolio Types

- Growth and Best Works (Nitko, 2015)
- **GROWTH**
 - Formative
 - Progression over time
- **BEST WORKS**
 - Summative
 - Final product



Groups for STEM Portfolio Activity

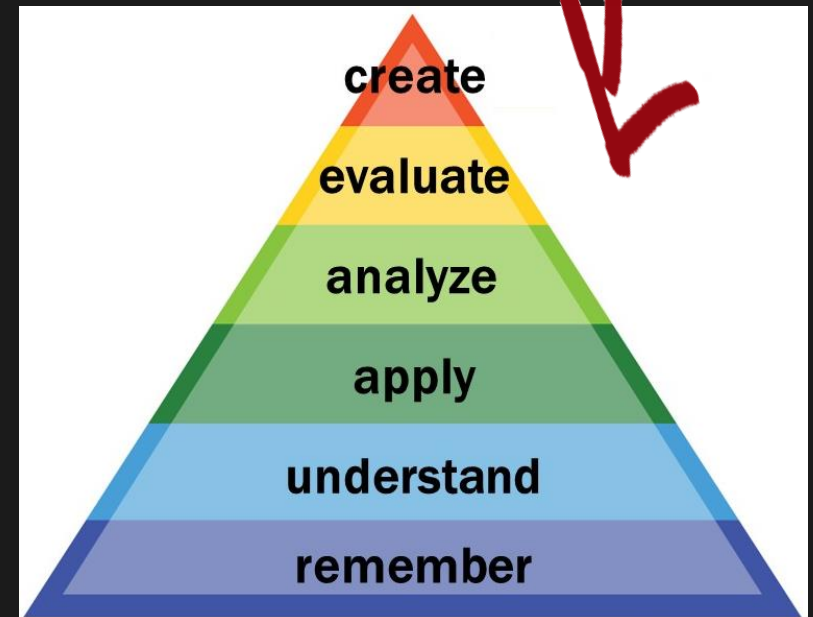
- Group One
 - Jess, Corinne, Carlyn, Anthony
- Group Two
 - Annie, Cassidy, Stephen, Kat, Dr. Powers?
- Group Three
 - Nicki, Sam, Megan, Jude-Mary, Brie

Rubrics

Overview and Activity

Purpose of STEM Rubrics

- Assess higher-order thinking skills in addition to content area knowledge
- Grade performance tasks, portfolios, and problem-solving tasks
- Improve reliability and validity of assessments
- Communicate teacher's expectations
- Provide opportunities for creativity and innovation



The Nature of Scientific Knowledge

EMPIRICAL: based on observations

TENTATIVE: new observations or interpretations

INFERENCE: scientific claims \neq evidence

THEORY-LADEN: influenced by backgrounds

EMBEDDED: within a wider culture

FOUNDED: on no specific scientific method

CREATIVE: models used to represent concepts

Sample Criteria for STEM Rubrics

- Synthesis of information
- Use of supporting details
- Use of accurate scientific terms
- Application of information
- Evidence of conceptual understanding



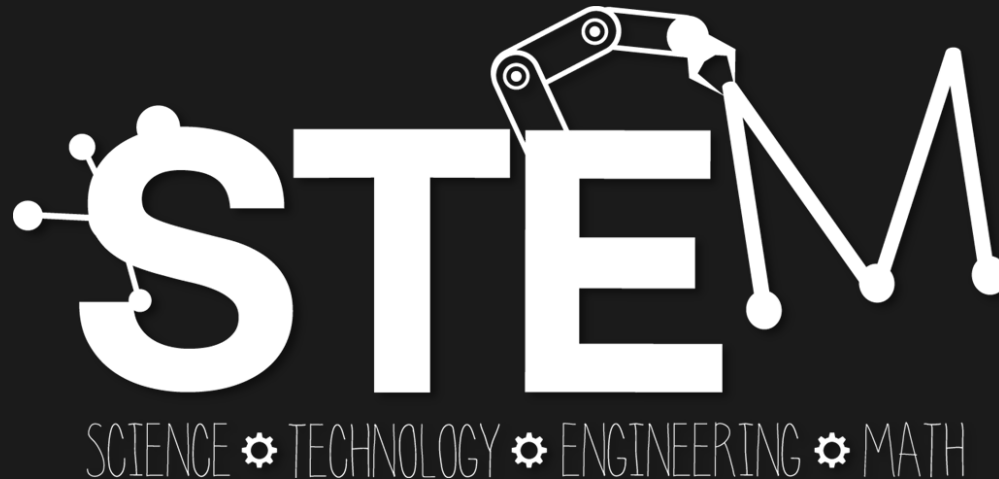
Sample Criteria for STEM Rubrics

- Communication skills (written, oral, visual)
- Applying correct formulas
- Reflection of learning
- Evaluation of data/sources



Your Challenge

- Each group will receive a STEM performance task.
- Select a HOTS that the task assesses.
- Create a criterion and describe the highest performance level.
- Share your criterion, performance level, and any challenges you encountered.



References

- Capraro, R. M., Capraro, M. M., & Morgan, J. R. (2013). *STEM project-based learning: An integrated science, technology, engineering, and mathematics (STEM) approach* (2nd ed.). Rotterdam: Sense Publishers.
- Cruz, H. L., & Zambo, D. (2013). Student data portfolios give students the power to see their own learning. *Middle School Journal*, 44(5), 40-47.
- Freeman, S., Eddy, S., McDonough, M., Smith, M., Okoroafor, N., Jordt, H., & Wenderoth, M. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America*, 111(23), 8410-8415. doi: 10.1073/pnas.1319030111
- Howes, A., Kaneva, D., Swanson, D., & Williams, J. (2013). *Re-envision STEM education: Curriculum, assessment and integrated, interdisciplinary studies*. The University of Manchester.
- Hull, M. M., Kuo, E., Gupta, A., & Elby, A. (2013). Problem-solving rubrics revisited: Attending to the blending of informal conceptual and formal mathematical reasoning. *Physical Review Special Topics - Physics Education Research*, 9(1) doi:10.1103/PhysRevSTPER.9.010105
- Kim, Y., & Yazdian, L. S. (2014). Portfolio Assessment and Quality Teaching. *Theory Into Practice*, 53(3), 220-227.
- Kishbaugh, T. L. S., Cessna, S., Jeanne Horst, S., Leaman, L., Flanagan, T., Graber Neufeld, D., & Siderhurst, M. (2012). Measuring beyond content: A rubric bank for assessing skills in authentic research assignments in the sciences. *Chem. Educ. Res. Pract*, 13(3), 268-276. doi:10.1039/C2RP00023G
- Kwon, H. (2015). Instructions innovation for creative convergence: Based on e-portfolio of Hanyang elementary school. *International Information Institute (Tokyo). Information*, 18(5), 1919-1924.
- Madden, M. E., Baxter, M., Beauchamp, H., Bouchard, K., Habermas, D., Ladd, B.,... Plague, G. (2013) *Rethinking STEM education: An interdisciplinary STEAM curriculum*. *Procedia Computer Science*. 20. 541-546.
- Pandey, T. (1990, November 30). *Authentic Mathematics Assessment*. ERIC/TM Digest. Retrieved April 01, 2017, from <https://eric.ed.gov/?id=ED354245>
- Quigley, C. F. & Herro, D. (2016). Finding the joy in the unknown: Implementation of STEAM teaching practices in middle school science and math classrooms. *Journal of Science Education and Technology*, 25(3), 410-426
- Randhawa, B. S., & Hunter, D. M. (2001). Validity of performance assessment in mathematics for early adolescents. *Canadian Journal of Behavioural Science*, 33(1), 14-24.
- Shymansky, J. A., Enger, S., Chidsey, J. L., Yore, L. D., & al, e. (1997). Performance assessment in science as a tool to enhance the picture of student learning. *School Science and Mathematics*, 97(4), 172-183.
- Sicklet, A. J., & Witzig, S. B. (2017). *Designing and teaching the secondary science methods course. An international perspective*. Dordrecht: Sense.
- Siegel, M. A., Halverson, K., Freyermuth, S., & Clark, C. G. (2011). *BEYOND GRADING: A series of rubrics for science learning in high school biology courses*. *The Science Teacher*, 78(1), 28-33.
- Tang, X., Coffey, J., & Levin, D. M. (2015). Reconsidering the use of scoring rubrics in biology instruction. *The American Biology Teacher*, 77(9), 669-675. doi:10.1525/abt.2015.77.9.4
- Whitworth, B. A., & Bell, R. L. (2013). *PHYSICS PORTFOLIOS*. *The Science Teacher*, 80(8), 38-43.