Final Reflection Paper

Quick and Easy STEM for the Non-science Classroom

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Quick and Easy STEM for the Non-science Classroom

The curriculum topics for this professional development focused on integrating STEM into specials classes (Spanish, art, music) as well as math and social studies. The PD took place at Ventnor Educational Community Complex (VECC); a K-8 school in a little beach town just south of Atlantic City, New Jersey with a small and diverse student population. Approximately half of the school receives free or reduced lunch, with about 40 percent white students, 40 percent Hispanic, twelve percent Asian, four percent black, and the rest two or more races.

Six colleagues participated in my professional development. This group included the K- 8 art, music, and Spanish teachers, the fifth-grade math teacher, eighth-grade social studies teacher and our elementary school librarian. (See Appendix A)

Many standards were addressed but varied depending on the activity that each teacher chose. All activities included technology and engineering standards along with science and/or math. Additionally, each teacher would add more specific standards according to their content area. A list of the most commonly used standards that can be applied across contents is located in the appendix (See Appendix B).

Project Summary

My primary objective for this PD was to provide my colleagues with low cost, low prep, easily accessible STEM lessons that could be integrated into their content areas as an integral part of a Universal Design for Learning (UDL) framework. Additionally, I intended to create a system for sharing supplies as a means of facilitating the successful implementation of the activities they chose. Lastly, it was my hope that we would initiate an on-going collaboration of cross-curricular STEM projects.

Pre-workshop Survey

The pre-workshop survey proved to be invaluable. As many of the articles we read throughout the course encouraged the use of pre-surveys as an important part of the PD planning process, I can’t say that I’d ever been asked to take one. Yet, as I was planning my PD, the questions that I needed to ask came to mind organically. I presented the survey using Microsoft Forms and anxiously awaited the responses. (Appendix C)

Generally speaking, the answers indicated that 5 out of 6 participants try to integrate STEM on occasion and one integrated it regularly. Also, all participants were using some form of technology in their classroom. Though

4 out of 6 had never heard of UDL. And while the types of technology used were varied, none of the participants noted NASA resources and all expressed concerns regarding time and supplies.

Professional Development Training

As indicated by the pre-survey, all the teachers shared an appreciation for STEM and were already integrating some level of technology. However, since nobody was familiar with the UDL framework, that's where I began. The agenda was as follows:

I. Introduction
   a. Obstacles to teaching and learning
   b. Universal Design for Learning framework
   c. UDL in the classroom
II. NASA Resources
   a. eClips V.A.L.U.E. Bundles
   b. Teams Page: Quick and Easy STEM resources
III. Integration into the Non-science Classroom
   a. Choosing an activity
   b. Gathering supplies
IV. Conclusion
   a. Future endeavors

Professional Development Activities

I opened with a PowerPoint presentation to identify the instructional challenges we face in the classroom and to offer UDL as a practical means of addressing those obstacles using NASA resources. I included a brief video which we watched together. I viewed several videos in preparation for my PD and landed on one from Katie Novak, a leading voice in UDL. I especially liked the analogy she used comparing UDL to a buffet vs. a casserole. Now, whenever I hand out a worksheet, I feel like I'm serving a casserole. We all agreed that putting out a "buffet" would be a more effective means of meeting our students' needs.

To set the table, so to speak, I first served up some NASA eClips V.A.L.U.E. Bundles as they are based on the tenants of UDL. Plus, it provided an easy transition into other NASA resources as a means of facilitating a UDL model. Moreover, having surveyed the types of technology my participants were interested in integrating, and being familiar with their content areas, I was able to individually tailor the resources I selected.

Next, I shared the Teams page I created. (See Appendix D) The page included links for each content area and the PowerPoint presentation, as well as Word and Excel editable data tables. I'm also hoping that it serves as a platform for future collaborations. From this Teams page, my colleagues browsed through the links and chose an activity to bring back to their classes.

To help facilitate the implementation of the activities, I also created an inventory sheet in Excel that we input items into to manage the materials, equipment, and other resources. As a result, we are hoping to commandeer an empty classroom to be used as a much-needed common supply area.

Finally, we talked about the different ways that we could collaborate on cross-curricular projects. We concluded that for the most part, I would teach the technology portion of the projects to be used in a variety of other content areas. For instance, I would teach Scratch, Microsoft Paint, or Google Earth which could then be utilized in Spanish, art, or social studies.

NASA Assets and Endeavor Resources

The list of NASA mission assets and Endeavor course resources used in my PD is long. It included JPL, NASA Espanol, Space Place, Mission Geography, eClips, Scratch, and Google Earth.

I introduced the NASA materials with NASA eClips V.A.L.U.E. Bundles (Varied & Accessible Learning Resources for Universal Engagement). Though most of them focused on astronomy, there was a bundle on sound and they are all based on the tenants of UDL, so it served as the perfect segue into individualized NASA STEM resources.

The math and art teachers were particularly interested in the JPL resources. The Mission to Mars unit fit in beautifully with the 5th grade science curriculum, and Art and the Cosmic Connection really drew the attention of the art teacher. The Spanish teacher was thrilled to find that Space Place had a Spanish language option, and the music teacher investigated Makey, Makey and Chrome Music Lab. The social studies teacher and I began collaborating on a project using Google Earth to map out the Oregon Trail, and the librarian entertained the possibility of setting up a makerspace area. Additionally, I will be expanding on Scratch and video editing (NASA eClips/Spotlite) to provide more avenues for future collaborations.

Post-workshop and Follow-up

For the post-workshop questions, I met with each of my colleagues individually. These are the questions we discussed:

What are your impressions of the UDL framework?

Do you view STEM projects as an effective tool for implementing the UDL framework?

Did NASA resources offer you low prep, low cost, easily accessible STEM activities that fit your curriculum?

What is the likelihood that you will collaborate on other STEM projects in the future?

In the end, everyone agreed that UDL is a great concept on paper. However, the time and effort it takes to provide a smorgasbord of activities to meet students' needs continued to feel almost insurmountable. Still, quick and easy STEM activities were viewed by all the participants as a way to provide students with more learning options. Furthermore, they all indicated that they were likely to return to NASA for additional activities, resources, and ideas. And perhaps most importantly, they also reported feeling less intimidated and more enthusiastic about integrating STEM and working across the curriculum.

Outcomes

Content

In the pre-workshop survey all participants expressed a favorable perspective regarding the integration of STEM into their classrooms and all were currently using some form of technology. The pre-survey also indicated that all participants viewed time constraints and cost as the main obstacles to integrating STEM. Directing participants towards specific low prep, low cost, easily accessible resources helped to alleviate some of these concerns as evidenced by the post-workshop survey. NASA resources were very well received and provided countless jumping off points in terms of content. Furthermore, participants conveyed a willingness to continue collaborating with colleagues on cross-curricular projects.

Pedagogy

The pre-workshop survey also indicated that none of the participants had concrete prior knowledge of the Universal Design for Learning framework. On its surface, UDL seemed comparable to differentiated instruction, but the video helped to distinguish the two and highlight the value in presenting multiple means of delivery. NASA resources are well-suited for achieving this goal. Through my follow-up discussions, teachers expressed their intention to

use the resources as bellringers, discussion topics, enrichment, GT projects, and assessments. The math teacher was particularly enthusiastic about the many options that will allow him to begin making a shift from worksheets to real-world applications.

Course Readings

Many of the readings throughout the course discussed the importance of pre-surveys as part of the planning process for designing a meaningful PD. The article, *Effective Teacher Professional Development*, makes the point that "States, districts, and schools could regularly conduct needs assessments using data from staff surveys to identify areas of professional learning most needed and desired by educators. Data from these sources can help ensure that professional learning is not disconnected from practice and supports the areas of knowledge and skills educators want to develop." (Darling, vi) This makes so much sense to me and proved to be instrumental in the design of my own professional development. Finding out where each participant stood in their understanding of UDL, their view of STEM, the use of technology in the classroom, and their goals related to the PD topic is really what brought true meaning to the workshop.

The research presented in *Preparing to Lead an Effective Classroom: The Role of Teacher Training and Professional Development Programs* also offers valid reasons for using a pre-survey to determine teachers' needs and interests. The article states, "Teachers assert that the most useful professional development experiences are teacher-driven and ongoing." (Berry, p 7). Surveying participants before and after a PD can help to ensure its success.

Despite my reservations and nervousness about giving this PD, it ended up exceeding my expectations. I know how I feel about PDs that seem like a waste of time with nothing to show for them and I didn't want my colleagues to walk away with similar sentiments. Fortunately, I can report that they did not. They all felt they had gained something meaningful in exchange for their time. Everyone left with at least one activity to integrate and many resources. We collaborated and made plans to continue with some cross-curricular projects. And we began organizing supplies to help implement the hands-on activities.

Reflections

Content

Primarily, this PD helped my participants recognize the vast number of resources available to bring STEM into any classroom. It also helped them navigate these resources by providing individualized links to explore. Furthermore, the collaboration promoted enthusiasm and generated a feeling of support as we move forward in our efforts to integrate more hands-on, minds-on activities into non-science subjects.

Pedagogy

Learning about the UDL framework reminded my colleagues about the importance of diversified instruction, while the opportunity to explore select sites and relevant topics provided new ideas about how to deliver such instruction. I don't think it was ever the case that teachers don't want to diversify. But rather, as bared out by the surveys, teachers feel limited by time and cost constraints. Taking inventory of shared supplies and working towards creating a common supply space helped to alleviate some of those concerns.

References

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Berry, B., Daughtrey, A., & Wieder, A. (2010). Preparing to Lead an Effective Classroom: The Role of Teacher Training and Professional Development Programs. *Center for Teaching Quality*. http://files.eric.ed.gov/fulltext/ED509718.pdf

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Darling-Hammond, L., Hyler, M., & Gardner, M. (2017). *Effective teacher professional development*. https://doi.org/10.54300/122.311

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Home | NASA Space Place – NASA Science for Kids. (n.d.-b). https://spaceplace.nasa.gov/

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Mission Geography - NASA. (n.d.). NASA. https://www.nasa.gov/stem-content/mission-geography/

MIT. Scratch – Imagine, Program, Share. (n.d.). Scratch - Imagine, Program, Share

NASA. (2025, March 19). *NASA en español - NASA*. https://www.nasa.gov/es/

VALUE Bundles | NASA eClips. (n.d.). https://nasaeclips.arc.nasa.gov/resources/valuebundle

Appendix A

Participant Information

Teacher	Subject	Grade(s)	Email
Greta Coleman	Music	K-8	gcoleman@veccnj.org
Debby Duff	Social Studies	8th	dduff@veccnj.org
Paige Elmer	Spanish	K-8	pelmer@veccnj.org
Russ Freeman	Math	5th	rfreeman@veccnj.org
Stephanie Polinski	Art	K-8	spolinski@veccnj.org
Renee Woerner	Library	K-4	rwoerner@veccnj.org

Appendix B

Standards

Computer Science and Design Thinking (2020) 8.2.5.ED.5 Describe how specifications and limitations impact the engineering design process.

Computer Science and Design Thinking (2020) 8.2.5.ED.4 Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).

Computer Science and Design Thinking (2020) 8.2.5.ED.3 Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.

Computer Science and Design Thinking (2020) 8.2.5.ED.2 Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.

Computer Science and Design Thinking (2020) 8.2.8.ETW.2 Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).

Computer Science and Design Thinking (2020) 8.2.8.ED.3 Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Science NJSLS (2020) 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Science NJSLS (2020) 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Science NJSLS (2020) 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Science NJSLS (2020) Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)

Science NJSLS (2020) MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

Science NJSLS (2020) MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Science NJSLS (2020) MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Science NJSLS (2020) MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Science NJSLS (2020) MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Mathematics (2023) 5.M.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

Mathematics (2023) 5.DL.A.4 Using appropriate visualizations (i.e. double line plot, double bar graph), analyze data across samples.

Mathematics (2023) 5.NF.B.6 Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

Mathematics (2023) 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

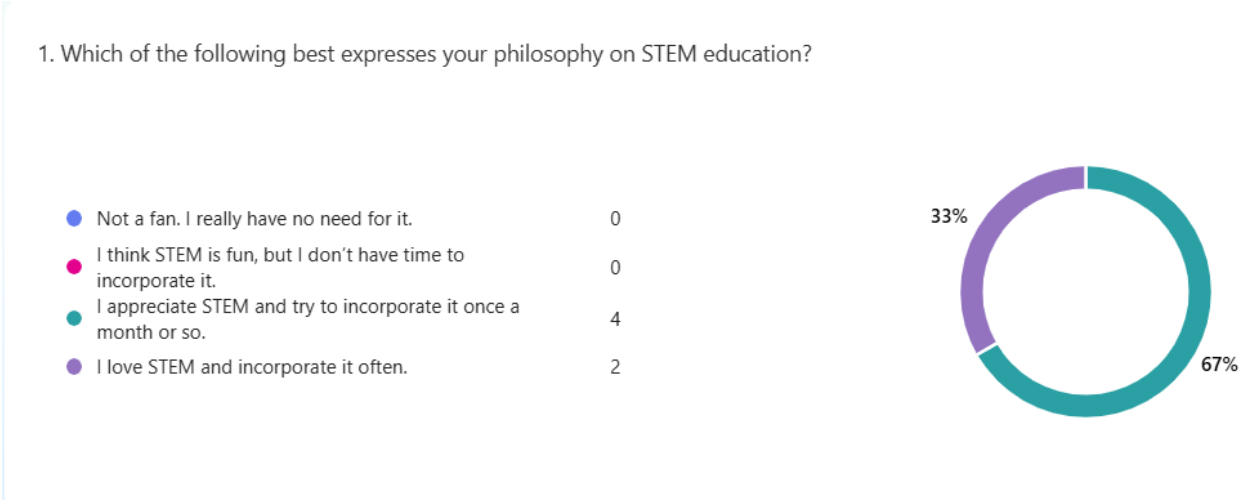
Mathematics (2023) 6.RP.A.3b Solve unit rate problems including those involving unit pricing and constant speed.

Mathematics (2023) 7.G.A.2 Draw (with technology, with ruler and protractor, as well as freehand) geometric shapes with given conditions.

Mathematics (2023) 7.G.A.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

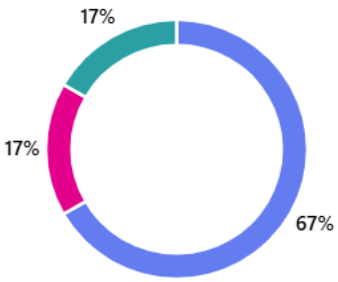
Appendix C

Pre-workshop Surveys and Responses



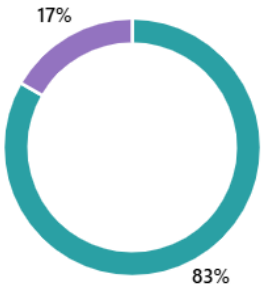
2. Are you familiar with the Universal Design for Learning (UDL) framework?

Not at all.	4
I've heard of it.	1
Somewhat familiar.	1
Very familiar.	0



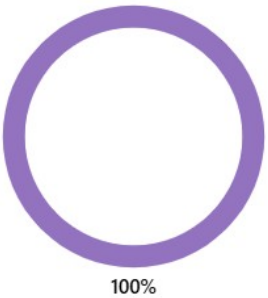
3. How often do you incorporate STEM into your lessons?

Never	0
Rarely	0
Occassionally	5
Often	1



4. How often do you use technology in your classroom?

Never	0
Rarely	0
Occassionally	0
Often	6



5. What types of technology do you and/or your students use in your classroom?

6 Responses

ID ↑	Name	Responses
1	Renee Woerner	Accelerated Reader, HMH for math
2	Russ Freeman	Computerized math practice sites, games, and activities.
3	Greta Colman	Chrome books, keyboards, makey-makeys, online music writing software.
4	Stephanie Polinski	laptops
5	Debbie Duff	Students use laptops, I use a smart screen, we utilize various online learning programs.
6	pelmer@veccnj.org	quizlet, quizzes, blooket, VHL central, teams

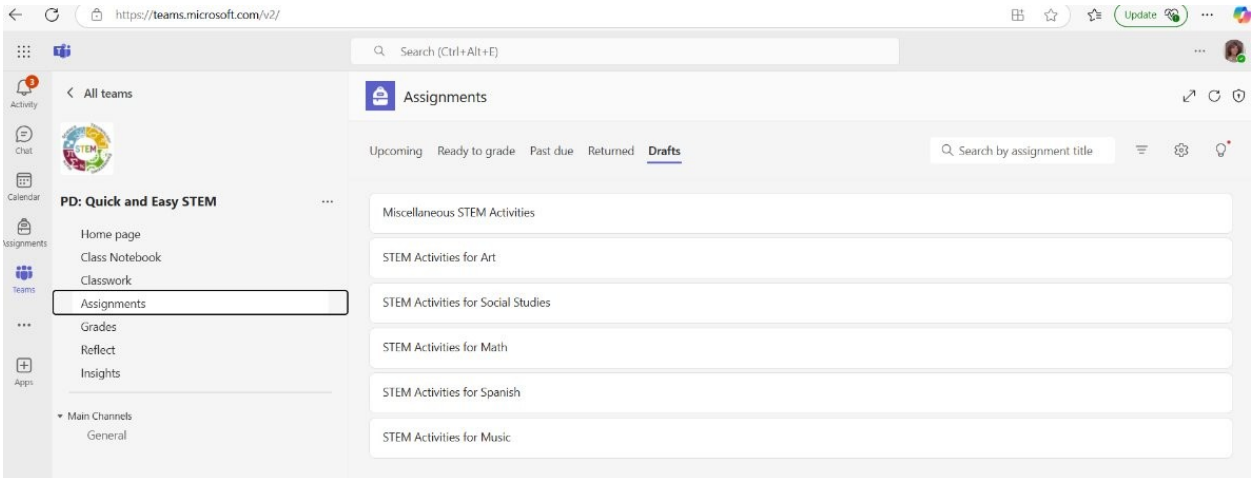
6. What are some obstacles that could make it difficult to incorporate STEM?

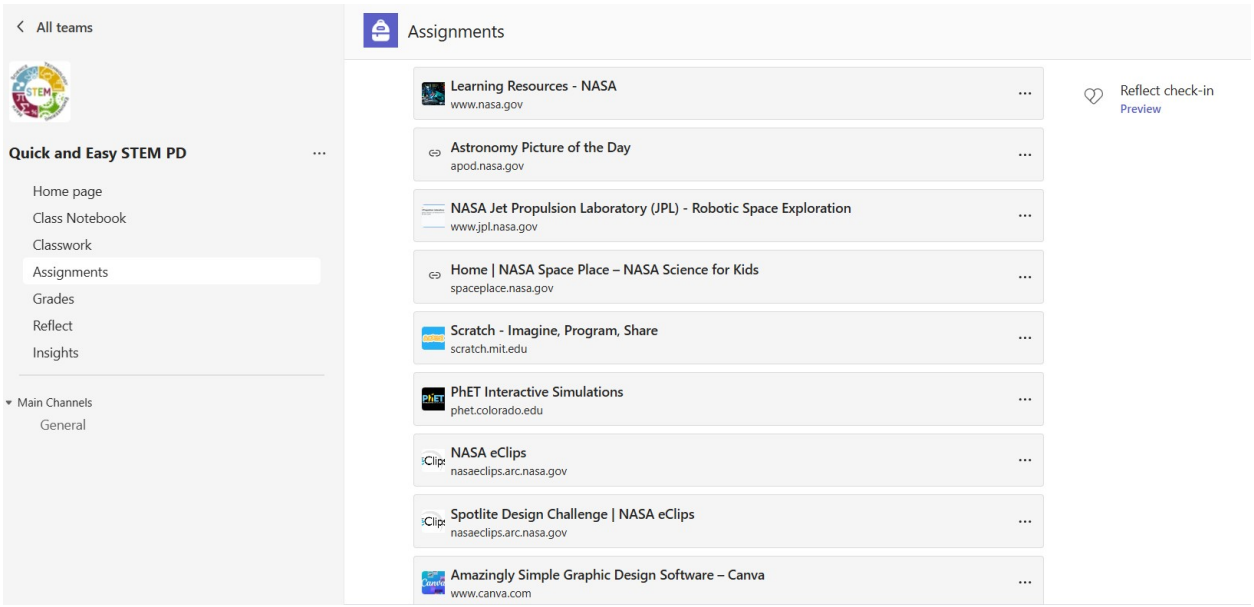
6 Responses

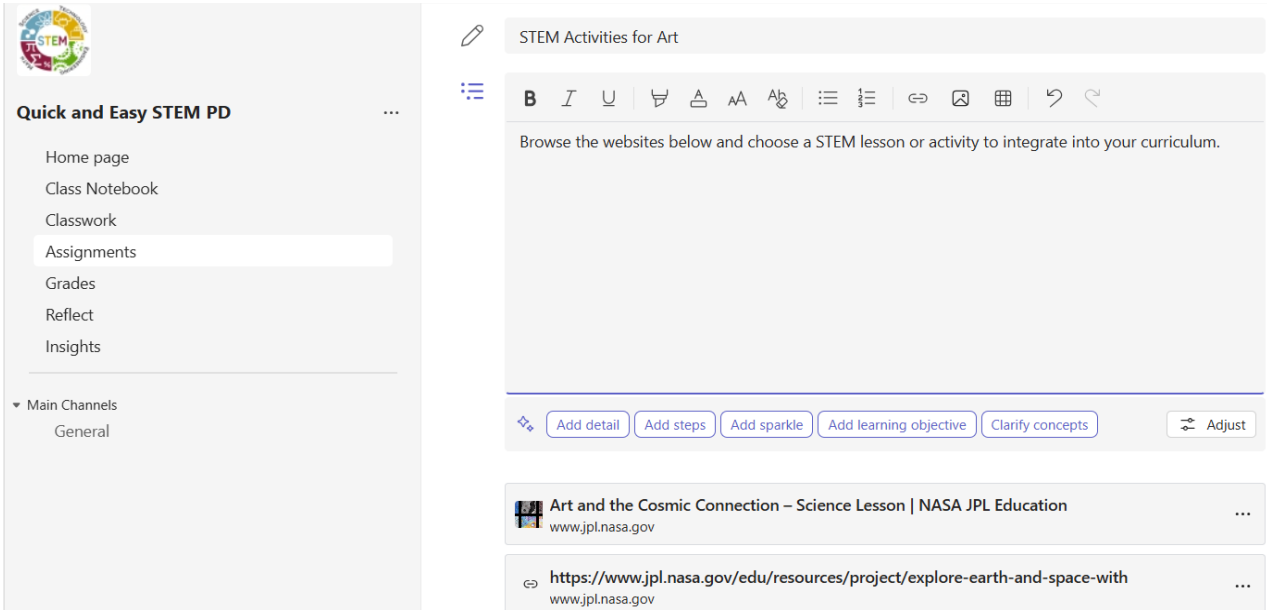
ID ↑	Name	Responses
1	Renee Woerner	STEM is the future! I'd love some ideas for incorporation.
2	Russ Freeman	Budget. Time. Materials.
3	Greta Colman	Student access to resources.
4	Stephanie Polinski	Time
5	Debbie Duff	Covering my topic and trying to include other information can be difficult due to time constraints.
6	pelmer@veccnj.org	There are resources that are not available without purchasing them.

Appendix D

Teams Page




All teams
Quick and Easy STEM PD
Home page
Class Notebook
Classwork
Assignments
Grades
Reflect
Insights
Main Channels
General
Assignments
Learning Resources - NASA
www.nasa.gov
Astronomy Picture of the Day
apod.nasa.gov
NASA Jet Propulsion Laboratory (JPL) - Robotic Space Exploration
www.jpl.nasa.gov
Home | NASA Space Place – NASA Science for Kids
spaceplace.nasa.gov
Scratch - Imagine, Program, Share
scratch.mit.edu
PhET Interactive Simulations
phet.colorado.edu
NASA eClips
nasaeclips.arc.nasa.gov
Spotlite Design Challenge | NASA eClips
nasaeclips.arc.nasa.gov
Amazingly Simple Graphic Design Software – Canva
www.canva.com
Reflect check-in
Preview


Quick and Easy STEM PD
Home page
Class Notebook
Classwork
Assignments
Grades
Reflect
Insights
Main Channels
General
STEM Activities for Art
Browse the websites below and choose a STEM lesson or activity to integrate into your curriculum.
Add detail
Add steps
Add sparkle
Add learning objective
Clarify concepts
Adjust
Art and the Cosmic Connection – Science Lesson | NASA JPL Education
www.jpl.nasa.gov
https://www.jpl.nasa.gov/edu/resources/project/explore-earth-and-space-with
www.jpl.nasa.gov