

A UDL with STEAM to support learning in children with Autism Spectrum Disorder(ASD)

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⟨Abstract⟩

Many educational strategies have been introduced giving practical instruction to support children with ASD in general education settings. Sometimes they are competing with one another in education. None is more important than the others, but teachers do not have enough time to learn, implement, and test these new strategies to determine which could be most beneficial for their students with ASD. The main purposes of this paper are to provide a practical sample UDL plan for practitioners and teachers to explore how to (1) design STEAM education for children with ASD so that each child can learn and express using his/her strengths, (2) support a child's needs including behavioral support with evidence-based practices, and (3) connect daily instruction monitoring to the future career assessment.

Keywords : Autism, UDL, STEAM, MTSS

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I . Introduction

The Every Student Succeeds Act (ESSA) of 2017 and the Individuals with Disabilities Education Improvement Act of 2004 (IDEA) ensure equal education opportunity for all children. Children with disabilities should be able to access the same Common Core Standards and have equal learning opportunities as their grade level peers in inclusive settings. The common themes of these two education laws are (1) the child's individual interests and strengths should be the focus of education and (2) the teacher should make instructional content accessible to all children with diverse abilities and needs so that every child is ensured success.

Autism Spectrum Disability (ASD) is a high-incidence developmental disability with a prevalence of 1 in 68 children (The Centers for Disease Control and Prevention, 2016). It is true that children with ASD share common diagnostic characteristics such as limited social interaction and difficulty in communication skills (American Psychiatric Association, 2013), but there is also great heterogeneity among them in terms of their abilities. According to the CDC report, about 31% of children with ASD are classified with intellectual disabilities. The other 69% of children with autism have a normal or above normal range of intelligence. About 77% are currently mainstreamed in general education or spend at least a half of their school day in general education setting (U.S. Department of Education, 2016).

It is not uncommon that children identified with ASD exhibit unique patterns of repetitive and restricted behaviors (Maye, Kiss, & Carter, 2017). Due to these unique behavior characteristics, professionals focus on providing supports for the socio-behavioral issues while the children are in the classroom setting. Various evidence-based practices have been recommended to support children with ASD in the instructional settings such as visual support (Kidder & McDonnell, 2017), video modeling (Bellini & Akullian, 2007; Haydon, Musti-Rao, McCune, Clouse, McCoy, Kalra, Hawkins, 2017), and power cards (Campbell & Tincani, 2017). Although visual supports can be used in teaching the academic content, many of the supports focused on the child's behaviors instead of focusing on equal access to instructional content.

Applied Behavior Analysis (ABA), with 50 years of research and practice, is one of the top intervention strategies which is empirically validated and federally recommended for ASD in the United States. In addition, behavior intervention during a child's first five years is critical to maximize improvement of his/her interaction and communication skills (Krantz, 2000). The parents of

children with ASD have consistently reported being satisfied with ABA-based intervention which directly focuses on the social skills deficits of children with disabilities using various reinforcements (Dillenburger, Keenan, Doherty, Byrne, & Gallagher, 2010). However, Daou, Hady, and Poulson (2016) reviewed the ABA intervention research articles and pointed out that there is the minimal generalization and maintenance of the social and affective behaviors, although the studies did report the effectiveness of intervention on these behaviors.

As Baer, Wolf and Risley (1968) noted, ABA's goals should focus on improving not only clinical, but also socially significant outcomes. Behavior analysts and teachers of children with ASD should study how to teach children with ASD engaging in social interaction with peers in natural settings. Many studies reported that a small group format intervention is more effective than the one-on-one format (Daou, Vener, & Poulson, 2014; Gantman, Kapp, Orenski, & Laugeson, 2012; Gayload-Ross, 1984; Krantz & McClannahan, 1998). To enhance the generalizability, the National Autism Center (2009) recommended including typically developing peers in the intervention. Moreover, the classroom environments closer to the natural settings will provide children with ASD with opportunities to access peer modeling, naturally occurring reinforcements, and prompting from the peers (Chan, Lang, Rispoli, Sigafos, & Cole, 2009; Zhang & Wheeler, 2011). When typically developing peers are not available in general education or community settings, peers who have the same level of social deficits bring similar results of effectiveness (Radley, O'Handley, Battaglia, Lum, Dadakhodjaeva, Ford, & McHugh, 2017).

Kim and Kimm (2015) implemented the peer-mediated learning strategy as an intervention to improve appropriate social behaviors while children were engaged in a reading comprehension project. The results of their multiple-baseline single subject design showed that all three children with ASD improved in their reading comprehension as the main contingent response through a peer-mediated inference-making activity intervention. Moreover, the study provided the effective collateral improvement of increasing verbal initiations and decreasing inappropriate behaviors during the peer-mediated reading-intervention phase. These findings suggest that the content instruction with well-prepared social interaction activities will promote not only the children's learning, but also their appropriate behaviors while they are integrated in general education settings.

The purpose of this paper is to introduce a practical sample lesson plan to demonstrate how to ensure content accessibility and behavior supports based on the theoretical framework and principles of Universal Design for Learning (UDL). This lesson plan will incorporate the Science, Technology,

Engineering, Arts, and Mathematics (STEAM) activities for a 3rd grade class. Moreover, a Multi-Tiered System of Support will be using a reward system that will be useful as a future career assessment tool.

II. Theoretical background

1. Evidence-based Practices

The concepts integrated into this sample lesson plan are the UDL (Universal Designs for Learning), STEAM (Science, Technology, Engineering, Arts, and Mathematics), MTSS (Multi-Tiered System of Support), and CCSS (Common Core State Standards). In this paper, each component is described in theoretical and research aspects. The next section explains the method to integrate these components into a real lesson plan based on the UDL framework that can be implemented in the classroom situation instruction for the 3rd graders.

1) The Universal Design for Learning(UDL)

The concept of Universal Design originated from the architect designing of products and environments to be usable by all people (Story, Mueller, & Mace, 1998). The “usable by all people” idea has been adopted in education to create instruction that is accessible by all children. Currently, UDL has been adopted by many professional organizations, government, and educational institutes including post-secondary education. The Higher Education Opportunity Acts of 2008 (HEOA) included provisions of UDL.

Universal Design Learning (UDL) is an educational framework that ensures the accessibility of learning to all children through three components: the multiple means of engagement, the multiple means of representation, and the multiple means of expression (CAST.org,2018;Meyer,2014).From the children’s perspective, the educational materials offered to them should be flexible enough so that they can access information in the way that is easily understand. Educational materials, contents, and activities should be motivating enough for every child. And children should be able to show what they have learned and demonstrate their knowledge in the best way that they choose. It seems that all teachers have been doing that minimally by providing examples, novel stimuli, and fun activities.

Good teachers might think they are already implementing the principles of UDL. Teachers prepare their lessons with thoughtfulness so that all children can learn and be engaged. However, the multiple means of expression is quite revolutionary in terms of children becoming active learning agents and teachers evaluating the learning of children in innovative ways that are completely different from the traditional evaluation format. Teachers need to experience and learn how each child's unique expression of learning can be evaluated.

Some teachers will not be motivated to use UDL because of its complexity and extended planning time. UDL is not yet fully understood by practitioners and teachers. UDL is for ALL children, but not as a collective group. UDL should focus on the accessing of information by each child, which is possible only when a teacher understands the individual child's strengths and needs in learning. The means of expression should be flexible enough so that each child can demonstrate his/her learning. UDL is not just providing a variety of instructional materials and activities that children can freely choose from. It is a well-planned and managed instructional preparation.

This practical UDL plan will explain how to prepare the equal access for all children and the method to motivate them, and how to evaluate the various forms of children's choices. The practitioners will explore new ways of evaluating the multiple means of children's expression using the performance evaluation rubric. The children will choose to demonstrate their learning in various forms of STEAM activities, and teachers will evaluate their performance based on the rubric developed based on the goals and objectives of the lesson. Moreover, this lesson highlights the records of children's participation that will turn into a powerful tool to assess each child's future career.

2) Science, Technology, Engineering, Arts, and Mathematics(STEAM)

Technology is becoming one of the basic competencies for the future success of children (Stohlmann, Moore, Roehrig, 2012). All children must have equal access and opportunities to learn technological knowledge and skills that are needed for their future careers. Since STEM was introduced by the U.S. National Science Foundation in 1998, education has adopted this idea for teacher education and encouraged the full implementation in general education. However, special education has been passive in implementing STEM education. In 2016, Art was added to make STEAM. STEAM should seriously be considered as practical instruction to be taught in Special Education. When STEAM is incorporated into the UDL, all children with different levels of abilities

and needs will have the opportunity to learn the content of their interest. And STEAM will promote inclusive teaching specifically to address all levels of children with ASD. The main principle of the UDL with STEAM activities is to utilize multimodal activities to engage a variety of learners to participate in grade appropriate curriculum. The children will be able to select their preferred approach to meet the learning objectives and evaluation.

Technology has been utilized in teaching children with ASD and found effective in improving academics, behaviors, communication skills, and social skills (Elicin & Kaya, 2017; Root, Stevenson, Davis, Geddes-Hall, & Test, 2016; Kim & Kimm, 2017; Kurkcuglu, Bozkurt, & Cuhadar, 2015). These studies used computers or mobile devices as instructional tools. Recent studies investigated directly the process of teaching technology and STEAM contents to children with disabilities. However, these studies focused on the use of technology as instructional tools to teach children with disabilities.

Recent studies have been focused on teaching technology and STEAM contents to children with disabilities with various supports such as explicit instruction and manipulatives (Taylor, Vasquez, & Donehower, 2017), mentoring (Sowers, Powers, Schmidt, Keller, Turner, Salazar, & Swank, 2017), and virtual mentoring (Gregg, Galyardt, Wolfe, Moon, & Todd, 2017). The results of these studies showed that children with disabilities can successfully learn the STEAM content with well-planned supports. The secondary data analysis of the National Longitudinal Transition Study-2 show that the children with ASD who took the advanced mathematic classes in high schools had higher probability of choosing a STEM major in college (Wei, Yu, Shattuck, & Blackorby, 2017). From these results, they recommended that STEM education should be broadening the participation of underrepresented groups, and one of the untapped talented groups is children with ASD. They echoed that children with ASD are more likely have interests and talents in STEM than other children with other disabilities. Children with ASD can fully participate and learn alongside their same aged peers in general education through STEAM activities using the UDL principles.

3) Multi-Tiered System of Supports

Multi-Tiered System of Supports (MTSS) began to be widely recognized when the Individuals with Disabilities Education Act (IDEA) was amended in 2004. MTSS emerged as the dual intervention system of Response to Intervention (RTI) and Positive Behavioral Interventions and Supports (PBIS) integrated into a comprehensive child support system (Dillard, 2017; Skiba & Sprague, 2008; Urtley

& Obiakor, 2015). Ferns (2017) defined MTSS as a coordinated school-wide system of high-quality instruction in general education for preventing school failure and avoiding disproportionate special education referrals. Although MTSS has been interpreted in various ways and implemented with a wide range of supports in the education field, the main goal of MTSS is to make sure that all children receive appropriate level of supports, based on individual needs, in order to access quality education and manage interfering behaviors based on individual's needs (Horner, Sugai, & Anderson, 2010).

MTSS is designed to create an integrated system of instruction and intervention guided by students' data, which addresses the multiple needs of children during instruction because learning and behaviors are not mutually exclusive. The effectiveness of the system is determined by various factors such as a high-quality plan for instruction, implementation of the evidence-based instructional strategies, ongoing progress monitoring, performance assessment, adaptations, professional development, and parent involvement (Dillard, 2017; Izaguirre, 2017). Moreover, MTSS can be effective for children with ASD when teachers can creatively design the instruction to include the ample opportunities of peer interaction, tasks and activities addressing the individual child's interests and strengths, higher expectations to learn Common Core such as STEAM, and collaboration and team-teaching, delegating the duties supporting the individual child with ASD during instruction (Kimm, 2018).

Studies show positive results in behavior management while children with ASD are involved in academic instruction, and the functions of behavior have been carefully assessed and the intervention plan is in place (Bice, 2009; Harrower & Dunlap, 2001; Fisher, 2006; Kim & Kimm, 2016). Fisher (2011) demonstrated how the behavior intervention plan could be successfully implemented in an inclusive setting. She emphasized the benefits of building positive relationships with peers during instruction. Although it is more challenging providing supports for children with problem behaviors during instruction in an inclusive setting, a specific supporting strategy (i.e., Prevent-Teach-Reinforce) is recommended to address these problem behaviors in class (Strain, Wilson, Dunlap, 2011). Calfant, Rose, and Whalon (2017) demonstrated how to teach children with ASD and to support in the general education classroom. They provided the pre-lesson (i.e., priming), paired peer supports, written schedules, and visual support cards. Their strategy reflects providing supports for instruction such as priming and peer support and supports for behaviors using written schedule and visual

support cards for children with ASD which can be learn successful.

2. UDL Plan with STEAM Activities

1) Basic Lesson Information

This form has the blank spaces for the title of the lesson, name of the teacher, date, grade level, and the subject area(s). The lesson plan should have the children's learning objectives that are aligned with the general education Common Core State Standards (CCSS). The lesson objectives should be written in observable and measurable terms. Moreover, it is important to consider objectives that target various levels of cognitive abilities based on Bloom's taxonomy (Anderson & Krathwohl, 2001). Make sure to write a reasonable number of objectives that can be accomplished by the end of the lesson.

2) Teaching Materials

List the materials that teachers need during this lesson. Consider materials from low and high technology devices. You will need different types of materials. One type is materials that children need for the class activities and the other type is teacher materials needed to deliver the lesson including internet access and the Apps or other software programs.

3) Multiple Means of Engagement

This is similar to the introduction of the lesson in the traditional lesson plan. In this section, teacher needs to design content and activities that will motivate children to become engaged in the lesson. One big difference is the way to motivate children. In UDL, it is from each child's perspective. Since each child has different interests, the teacher should consider various ways to trigger each child's interest. Examine ideas from the multi-modality of learning (Reiff, 1992) and/or multiple intelligence (Gardner, 2006). Each child will have a unique channel accessing the information presented. UDL framework emphasizes the multiple means of engagement to allow children have equal access to learning. It has important implications for teachers to think proactively and positively about the individual characteristics of how children learn, which is different from providing special accommodations and adaptations for children with disabilities and just targeting

inappropriate behaviors of children with ASD.

4) Multiple Means of Representation

Probably, this is the section that many good teachers are already trying to improve in their teaching. Various teaching strategies are recommended such as Venn-diagram, jigsaw, scaffolding, concept mapping, inquiry-based learning, role playing, activity-based learning, and so on (Partin, 2005). Teachers should plan how to get each child, with different strengths and interests, involved in the learning activities. Each individual child with disabilities should be provided with prompts and guided practices. The behavior intervention plan for children with ASD should be implemented while the lesson is in progress.

5) Multiple Means of Expression

This section is the least familiar to teachers who are using traditional instructions. The multiple means of expression of the UDL allows children to demonstrate what they have learned in various ways of their own choice. However, it is not a completely random choice for the children. This should be well planned, managed, and evaluated. This is the “ACTIVITY” section of this sample lesson, where STEAM should be incorporated into learning. Teachers should creatively design children’s activities in terms of small group activities where children can express their learning in Science, Technology, Engineering, Arts, and Mathematics. Not every lesson can be designed into all of five activity groups. It’s the idea that teachers should try to develop in STEAM group activities. As you can see in this lesson plan, technology has three different activity groups based on the types of technology (i.e., low, medium, and high technology).

Art is also divided into two small groups, music and performing arts. You may add fine arts, crafts, designing, and so on. It is very important to design class activity groups based on STEAM. Many children with autism have higher functioning abilities and exhibit unique talents in arts, math, and technology. Children with intellectual disabilities will also experience learning technology skills through STEAM activities. Moreover, STEAM education will prepare them for the future. One thing that teachers should understand is that children do not need to go around and complete each group activity. Each child chooses a group and completes that group’s activity.

<Table 1> Lesson Title: The Three Little Pig

Teacher(s): C. Kimm

Date:3/16/2018

Grade: 3rd Grade (Full Inclusion)

Subject: Integrated subjects (ELA, Math, Science)

Lesson Objective(s)/CCSS: State the measurable and observable objectives and align them with Common Core.

<p>CCSS.ELA-LITERACY.RL.3.2 Recount stories, including fables, folktales, and myths from diverse cultures; determine the central message, lesson, or moral and explain how it is conveyed through key details in the text.</p> <p>CCSS.ELA-LITERACY.SL.3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.</p> <p>CCSS.MATH.CONTENT.3.MD.C.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.</p> <p>Science Content Standards (CA Department of Education) 5. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.</p>	<p>Learning Objective</p> <ul style="list-style-type: none"> ▪ Student will identify the moral of the story of The Three Little Pigs and its real-life implications ▪ Recreate the story based on the lesson (moral) learned from The Three Little Pigs <p>Enduring Understanding Connections can be formed between literature and life (STEAM focus)</p> <p>Essential Question What can readers learn from literature (stories)?</p> <p>Key Concepts & Terms: -Identify the “theme” of the story -Identify the moral from a fictional piece of text.</p>
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Materials Needed/Use of Technology: *List the materials that you need for this lesson including low/high technology. If you are presenting this lesson collaboratively, make sure list the collaborators and their roles here.*

<u>For Student Activity</u>	<u>For Instruction</u>	<u>APPS used</u>
<ul style="list-style-type: none"> ▪ Laptop/ internet access ▪ Handouts (Thinking Maps- Flow Chart, Sequential Map, Circle Map, Double Bubble) ▪ Writing supplies (pencil, pen, eraser) ▪ Graph paper (for blueprint, pre-planning) ▪ Building materials (toothpick, index cards, straws, popsicle sticks, play-dough) ▪ Poster board/ construction paper ▪ Masking Tape/ strong tape ▪ Scissors ▪ Brick, Stick, Straw ▪ Fan 	<ul style="list-style-type: none"> ▪ InterNet access ▪ Tablet, Laptop ▪ Soundtrack- (types of weather) ▪ YouTube NEWS files ▪ Photo images: dwelling types 	<ul style="list-style-type: none"> ▪ Touch ▪ NearPod ▪ Scratch ▪ SmartDraw ▪ PlayBilder ▪ NoteFlight ▪ Popplet

Multiple Means of Engagement/Teacher's Input: *Include the opening remarks/activities to motivate students (e.g., reviewing previous lesson, stating the overviews of your lesson). To motivate children, you need to present information to grab their attention and interest. Consider different learning modality and/or multiple intelligence of each child.*

<p>Contents to motivate students Teacher will guide and ask the students to:</p> <ul style="list-style-type: none"> ▪ Look at different types of dwellings ○ Identify how houses may look different (shape and size) depending on where someone lives ○ Question why houses are all different ▪ Listen to soundtracks (hail, storm, heavy wind, sunny day) ○ Question how the students feel when listening to the weather (ask the student to pretend that they are at home) ○ Explore how the weather will impact the exterior look of the house ▪ Watch YouTube videos of unsafe/ safe homes ○ Guide the students to answer discussion questions: What did you observe from the videos? What does it take to have a sturdy (strong) house? (Socratic Method) 	<p>MULTI MODALITY & Multiple Intelligence</p> <ul style="list-style-type: none"> ▪ Visual: pictorial images of different homes, videos of unsafe home (Google Images) ▪ Audio: Listening to the soundtrack of rain, storm, and "sunny day" (birds) (Soundbible, 2018) ▪ Tactile: Touching samples of building materials
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Multiple Means of Representation/Guided or independent Practice:

Individualize with each child's abilities (e.g., Paper-pencil, product, oral presentation, making video, collage, constructing a model project, etc.). Make sure to provide multiple means of representation with adaptations/prompts to maximize the accessibility of learning materials. Describe your instructional contents and activities on the left column. Think of the UDL's multiple means of representation and write them in on the right column.

<p>Instructional Content Teacher will:</p> <ul style="list-style-type: none"> ▪ Guide the students to examine the story, The Three Little Pigs <ul style="list-style-type: none"> ▪ Allow the students to examine the story in his/her preferred media format (e.g., book, audio, video, or combination) ▪ Allow the students to read, listen, watch the text in his or her preferred setting (classroom library, on the floor, in a small group) ▪ Guide a small group of students to complete the reading with the guidance of a teacher/ instructional aide (as needed) ▪ Survey the classroom to monitor understanding and behavior ▪ Use Socratic method to discuss the story (i.e., jigsaw, think-pair-share) ▪ Guide the students to answer the questions about the story: <ul style="list-style-type: none"> ▪ What are some clues that the Third Little Pig's house was sturdier (stronger) than the First/Second Little Pig's house? ▪ What lessons can we learn from the Three Little Pigs about life and about building houses? ▪ Guide the students to complete a thinking map to clarify the lesson <ul style="list-style-type: none"> ▪ What would you use to build the house? ▪ Using the sequential map and/or double-bubble, compare two characters from the story, circle map-generate ideas ▪ Complete knowledge checks 	<p>MULTI MODALITY & Multiple Intelligence</p> <p>Materials</p> <ul style="list-style-type: none"> ▪ Visual: Watch the story of The Three Little Pigs (KiddoStory, 2014), Thinking Maps ▪ Audio: Listen to the story of The Three Little Pigs (Storynory, n.d.). ▪ Tactile: Touching samples of building materials <p>Instructions:</p> <ul style="list-style-type: none"> ▪ Evidence-based instructional strategies ▪ Adaptations ▪ Prompts
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Multiple Means of Expression/Closure and Evaluation: *How will students demonstrate what they have learned? Provide STEAM Projects/activities allowing multiple pathways for students to be engaged in learning (e.g., small group vs. independent practice, various leaning activities such as science experiments, building project, arts/crafts, writing, making music, drawing, singing, acting out, math problem solving, and so on). Attach the checklist/rubric(s) how to quantify the various expressions of learning outcomes.*

The students choose the preferred small group activity to demonstrate the evidence of their learnin

1. Identify the moral of the story of The Three Little Pigs and its real-life implications
2. Recreate the story based on the lesson (moral) learned from The Three Little Pigs

Small group activity options (STEAM based grouping)

- Science Group: Write the hypothesis and test out the houses using a fan, document the result, summarize findings, and make recommendations
- Technology Group (Low Tech): Rebuild the story using Play-Doh and “Touch” Application to animate/ express the lesson learned from the story (2018)
- Technology Group (Mid Tech): Illustrate a comic strip using pictures and/or words, design using NearPod (2018)
- Technology Group (High Tech): Design the animation using the computer coding program demonstrating the lesson using the Scratch (2018)
- Engineering Group: Design three houses with different materials. The advanced child can design a blueprint of a stable house and estimate the materials necessary to build a secured house. Use SmartDraw to help design the Blueprint (2018)
- Art Group 1(Performing Art): Create a play to retell the story and create a Play Bill using the interactive website from Scholastic (or Book Wizard Mobile) (2018)
- Art Group 2(Music): Sing a song to illustrate the story of The Three Little Pigs and use NoteFlight to design a music sheet and play back (2018)
- Math Group: Create a multi-tier flow map to retell the story and identify the moral. Use Popplet to design the flow map with peers (2018)

The teacher will use survey the classroom, monitor students’ understanding, and provide guidance. The teacher will allow the students to be creative and practice critical thinking. The teacher will challenge the students to develop meaningful projects through feedback. The teacher will evaluate the project(s) using the Rubric (see Table 1). When possible, allow peer-evaluation using the rubric and checklist.

Extension skills/Enrichment skills: *Plan how you can facilitate students to initiate and to terminate, to monitor own quality of work and tempo, and to problem-solve. Plan for communication skills, positive behavior support, generalization, choice making, etc.*

Extension/Enrichment Activities

- Students will reflect on their projects and take notes on how to improve their final products.
- Science test for the building material (i.e., elasticity, inflammability, intensity, corrosion-resistance, wear resistance, heat reservation)
- Peer evaluation (Allow the students to critique and support other students’ work).
- Present their products to another class and events.
- Share their group products online class website (e.g., Google Share, YouTube, Class website).
- Recreate the assignment using a different perspective/modalitiy.
- Fieldtrip to the construction sites

Instructional/Behavioral Support should be considered (Think MTSS and IEP)

- Lesson is all inclusive
 - Collect data to further support the students with IEP goals).
 - Provide accommodations and adaptations to meet the needs of individual student.
- Planned Positive Behavior Support:
 - Close/peer monitoring
 - Self-monitoring, Staff data-collection
- Promoting growth mind-set, allow the students to think critically and perform creatively.
- Active Interaction and teamwork are critical (see the evaluation rubric).

〈Table 2〉 Students Performance Evaluation Rubric

UNDERSTANDING OF...	1	2	3
Story/ Theme Vocabularies/ sequence of the story	Student has some understanding of the story/ theme through the project. Say some of the names of the animals and vocabularies. The story may not be sequenced completely or includes missing elements to fully assess understanding.	Student demonstrated an understanding of the story/theme through the project by utilizing creative elements/resources. Say the names of the characters and settings in the story. They can sequence the story.	Student demonstrated a thorough understanding of the story/ theme through the project by utilizing creative elements and resources. They can compare and contrast the characters in the story. They can recreate the story. They can retell the story to others.
Moral/ Life Lesson/ Connection to real life.	Student has some understanding of the moral of the story. The student's message may be unclear. The student may struggle to apply the moral/ lesson to real life setting.	Student demonstrated an understanding of the moral/ lesson learned from the story, <i>The Three Little Pigs</i> by clearly stating the moral. The students used some creativity to show reveal his/ her understanding. Student made references to real-life application.	Student demonstrated an understanding of the moral/ lesson learned from the story, <i>The Three Little Pigs</i> by clearly stating the moral. The students used creativity and multiple resources to demonstrate his/ her understanding. Student applied their understanding through real life application
Collaboration	The student shared minimal ideas with his or her partner(s). The student may not have gotten along with his or her peer(s). The student may not have maximized instructional time.	The student shared ideas with his or her partner(s) and made meaningful contributions to the project. he student worked well with his or her peer(s). The student worked well with his or her peer(s). The student worked throughout the period.	The student actively shared ideas with his or her partner(s) and made meaningful contributions s to the project. The student had excellent relationship(s) with his or her peers). The student maximized the time given in the classroom to work on the project.
Presentation	The project may present basic components from the story (e.g. characters, setting, relationship).	The project presents the lesson from the story using the medium of their choice. Most critical points are demonstrated in the project.	The project shows the creative re-creation of the story. The project delivers the lesson to the audience from the newly reconstructed story.

To evaluate and measure children's learning, teachers need to create a rubric for evaluation (see Table 2). The rubric will be developed based on the lesson objectives which are listed at the top of the lesson plan. In this lesson, they should (1) identify the moral of the story and (2) recreate the story. The first objective, identifying the moral, will be evaluated with two criteria: one is to comprehend the story itself with the vocabulary and story sequence and the other is to understand the moral of the story and to connect the story to real life examples. These two criteria will be first and second criteria on the evaluation rubric. The second objective, recreating the story, will be also evaluated with two criteria: one is to collaboration and the other is presentation. Collaboration needs to be evaluated because the recreation of the theme of the story is the group activity in which they must collaborate with team members. The presentation is an important part of the evaluation to show the success level of the creativity of the story. That's where children can get involved in the team learning and be creative, expressing their ideas through STEAM learning. Although everyone will participate in different activities, everyone can be evaluated with the same criteria. Children with autism will benefit from this STEAM learning by exploring their interests and extending their knowledge and skills in the areas of their strengths.

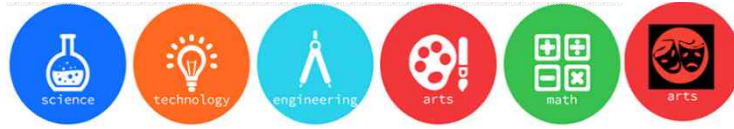
This lesson can easily be planned to extend its learning activities into further enrichment activities. Most of all, children can have time to reflect on group activities, what they learned and what they can do to improve their expression. They can document their group activities and share online. Furthermore, they can link it to higher levels of knowledge. For example, the science group can test the building materials (i.e., elasticity, inflammability, intensity, corrosion-resistance, wear resistance, heat reservation).

7) Instructional/Behavior Support (MTSS)

Of course, this UDL plan should include support from the Multi-Tiered Support System for both instruction and behaviors. The goals and objectives of the IEP should be reflected into this plan.

Teachers and Para-educators should document each child's learning progress toward his/her IEP goals. For the child with a behavior support plan, the teacher should include behavior interventions along with the reinforcement schedule, data-collection, self-monitoring, and recording. All children will be on the reward system. Upon the successful completion of the STEAM activities, they will earn the sticker representing the STEAM group in which they participated to add to the reward sheet for their STEAM certificate (Table 3).

<Table 3> My progress toward STEAM Certificate (2018)



Name: _____ Grade _____

Date:	Date:	Date:	Date:	Date:	Date:
Date:	Date:	Date:	Date:	Date:	Date:
Date:	Date:	Date:	Date:	Date:	Date:
Date:	Date:	Date:	Date:	Date:	Date:
Date:	Date:	Date:	Date:	Date:	Date:
Date:	Date:	Date:	Date:	Date:	Date:
Date:	Date:	Date:	Date:	Date:	Date:

- This will collect the team-work stickers to earn the certificate of your expertise.
- You need to earn at least one certificate from each area to complete your certificate.

When they complete the whole reward sheet in Table 3 with stickers, they will receive a certificate as one of the STEAM field experts or multiple field experts. For example, each child will receive a certificate recognizing him/her as the “3rd grade Scientist,” or the “Multi-Talented.” When the certificates are collected at year’s end, they will show each student’s definite interests and strengths in a certain field. This is much stronger evidence of their interests and strengths as a career assessment than any assessment tools that are administered on a one-time paper-pencil test. Children with ASD who are characterized with difficulty in communication and interaction can benefit from this cumulative record of their interests and strengths in STEAM activities to assess their future career. Moreover, this UDL with STEAM activity learning will provide full equal-access to all children including those with ASD.

III. Issues

Although UDL with STEAM activities has significant advantages over the traditional instruction methods to meet the needs of children with ASD, the preparation is a time-consuming process and requires much creative thinking. It is a challenging task for teachers who are already inundated with duties such as managing behaviors, facilitating interaction among children, collaborating with other professionals, paperwork including IEP and behavior intervention, and providing effective instruction. It is extremely important to join teacher support groups sharing the resources and UDL lesson plans (e.g., www.cast.org). Moreover, it is not a simple plan for every class. It can be handled like a unit plan that can be implemented in a block scheduling pulling two instructional time periods together or over several instructional days.

The key point is that the UDL plan with STEAM activities can be used as a sound career assessment in a cumulative aspect of recording. This can be accomplished when this is implemented schoolwide. In addition to serving the assessment function, it takes schoolwide and system-wide time and commitment for a child to build knowledge and skills in STEAM areas. Children should be encouraged to be immersed into the STEAM education throughout their school life. Many schools have adopted and encouraged teachers to transform their instructional practices based on the UDL principles which allow the children to express the learning evidences in multiple ways. However, schools and society are still bound to one formal form of evaluation (i.e., paper-pencil) of the final performance. Post-secondary education institutes are using traditional evaluation methods such as SAT and GRE as the entrance criteria. Changing the instructional strategies could be the first step, but the whole education system and society should soon adopt the new way of evaluating people's abilities.

The UDL provides a solid theoretical framework for delivering education to children ensuring them equal access. UDL has attracted the attention of many organizations and government and it is being reflected in the LAWS!! However, it has not yet been researched to provide evidence of its effectiveness. Because this is a huge "theoretical framework concept," it is difficult to operationalize and to control the variables. UDL can be planned and implemented in various ways. Moreover, there will be a long time-gap between the intervention (e.g., UDL lesson) and the results (e.g., children's learning and behavior outcomes). Research investigating the effectiveness of UDL should be conducted. In addition, the impact of UDL providing equal access to children with ASD in the areas

of their interests and strengths should be conducted to determine whether the small group interactions in UDL with STEAM activities would improve not only the gain of academic knowledge, but also the acquisition of more appropriate social behaviors.

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자폐아동의 학습을 지원하기 위한 보편적 설계와 STEAM

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많은 교육적 전략이 도입되어 일반교육환경에서 ASD 아동을 지원할 수 있는 실용적인 지침을 제공하고 있다. 때로는 교육 현장 내에서 서로 경쟁하듯이 각 전략이 매우 중요하다고 역설하고도 있다. 그러나 교사는 ASD 아동을 위해 가장 그들에게 필요하고 유익한 전략을 결정하기 위해서 새로운 전략을 배우고 구현하고 테스트 할 시간이 부족한 현실이다. 따라서 본 연구의 목적은 실무자와 교사가 (1) 학생의 강점을 활용하여 학습하고 표현할 수 있도록 유도하는 STEAM교육을 설계하는 방법, (2) 증거기반 실천을 통해 행동지원을 포함한 학생들에게 필요한 지원을 제공하는 방법, (3) 미래 직업 평가에 대한 일상적인 지시 모니터링을 연결하는 방법에 대해 소개하는 데 있다.

주제어: 자폐, 보편적 설계, STEAM, MTSS

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