DUKE ENERGY.

Educational Foundation of Lake County

Educational FOUNDATION of Lake County

2018-19 Duke Energy Foundation STEM Grant

DEADLINE March 15, 2019 4:00 pm Foundation Office via Jackrabbit or Email (weidnerg@lake.k12.fl.us)

- This Classroom Grant is for 2018-2019 school year.
- Funds must be used to address a STEM related project.
- All funds must be used by May 1, 2019. A final program evaluation must be submitted by May 15, 2019.
- Requires signature of principal and requesting party

Contact Information	
Applicant Name: Katie Conner	Position: VPK Teacher
School: Triangle Elementary	
Address: 1707 Eudora Road Mount Dora, 32757	
Phone: (352) 383-6176	Fax: (352) 383-6674
Email Address: connerk@lake.k12.fl.us	

Detailed Project Information
Project Title: "Don't Be A Blockhead! Learn To Build STEM Style"
What priority area(s) will your project address: engineering, math, language/literacy
What is your estimated start date: IMMEDIATELY
Estimated number of teachers who will participate in this project: 1-10
Estimated Number of Total Students Impacted by project: 20-140
Grade Levels to be Addressed: Pre-K and Kindergarten

Program Background: While I have the privilege to lead a developmental Pre-K program in a Title I school, I long to influence more than just my own class of 20 students with the exciting opportunities that the requested materials offer. I am absolutely convinced that designing and building 3-D objects positively impacts brain development with potentially significant results!

SEE ATTACHED RESEARCH :)

Project Summary: A FANTASTIC 3-D BUILDING UNIT that will travel between Pre-K and kindergarten classes. Age appropriate building plans and materials, as well as games, will give young learners the chance to explore, perceive, create, and compare 3-D objects. Students will work w/teachers, each other, and independently.

Need: Please see attached list w/item requests from the Lakeshore 2019 catalog and amazon.com.

Project Goals and Objectives: Give students hands on experiences to plan and build 3-D objects collaboratively. Students will read, write/draw, think, and talk together and with teachers!

Evaluation Plan: *Describe how you will measure outcomes and evaluate your project.*
We will use photographs to record and celebrate student engagement.

Budget

Category of Expenditure		Dollar Amount		Related Activity
Computer Hardware				
Computer Software				
Other Equipment (not computers)		$535.26		3-D Building Unit
Competition Registration Fees				
Program supplies				
TOTALS		$535.26		

Program Approved By: _____
Principal

Funds Payable to: Triangle Elementary School
Address: 1707 Eudora Road
Mount Dora, FL 32757
Phone: (352) 383-6176 **Email:** connerk@lake.k12.fl.us

Requesting party has read and agrees with the funding policies of the Educational Foundation.

Signed K. H. Conner **Date** 3-8-19

To be completed by foundation staff/board

Program meets Duke Energy Foundation's Mission/ Funding Policy _____Y _____N

Director Recommendation: _____

Executive Board Recommendation: _____

Educational Foundation of Lake County

2018-19 Duke Energy Foundation STEM Grant

Katie Conner @ Triangle Elementary

"Don't Be A Blockhead! Learn To Build STEM Style"

Thank you for your consideration! As an early childhood educator, I KNOW the benefits of learning through play for young children. Sadly, I can only influence 20 students per year. This proposal is to create a FANTASTIC 3-D Building Unit that will travel between Pre-K and Kindergarten classes, so you can grant the most bang for your buck! I would like to order building resources that include manipulatives that challenge students to create 3-D items with age appropriate materials.
(So many children today experience lots of media but very limited hands-on engagement.)
The requested resources will excite and engage young minds and actually improve brain development!

They are all STEM and district aligned to foster reading, writing, thinking, and talking collaboratively!

ITEM #	DESCRIPTION	COST
LAKESHORE 2019 Catalog		
DG547	Magna-Tiles Class Set	$129.99
EE329	Magnetic Pattern Block Builders	$49.99
TT223	I CAN BUILD IT! Architecture Set	$39.99
FF579	BLOCKS & BLUEPRINTS LEARNING CENTER	$49.99
FF559	Extra Wooden Blocks	$29.99
LC644	WRITE & WIPE BLUEPRINT MATS	$19.99
amazon.com		
	BLOCKS Rock! game	$59.99
	Equilibrio game	$27.82
	Tangramino game	$34.95
	"Rosie Revere, Engineer" book	$8.99
	"Rosie Rever and the Racous Riveters: The Questioneers Book #1" book	$11.37
	"Rosie Rever's Big Project Book for Bold Engineers" book	$13.45
	"Iggy Peck Architect" book	$14.19
	"Iggy Peck's Big Project Book for Amazing Architects" book	$10.49
	"The Most Magnificent Thing" book	$11.86
	"How a House Is Built" book	$7.99
	"Look at That Building!" book	$14.22
	TOTAL	**$535.26**

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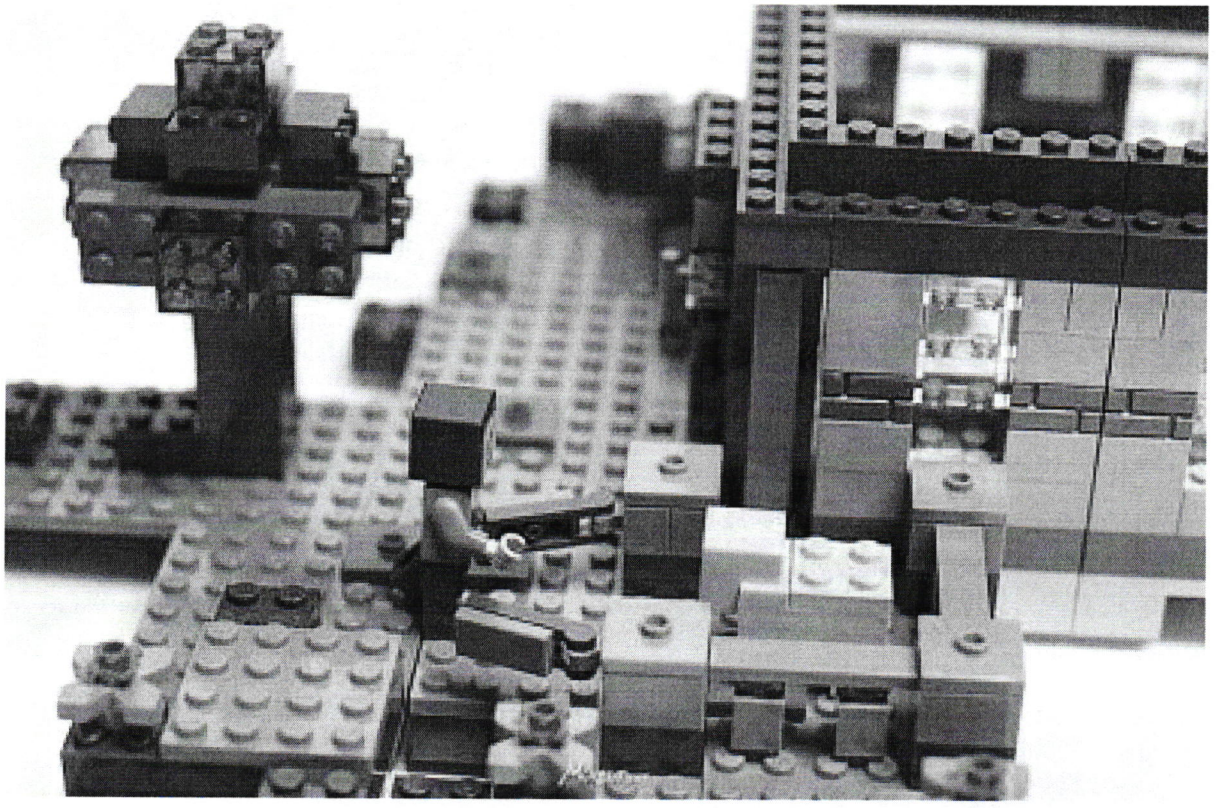
The benefits of toy blocks: The science of construction play



Toy blocks, also called "building blocks," are solid shapes used for construction play.

Some are simple planks made of wood. Others are fancy, like the interlocking bricks of plastic made by Lego and MegaBlox.

But whatever form they take, blocks can function as powerful learning tools. Studies suggest that toy blocks can help children develop

- motor skills and hand-eye coordination,
- spatial reasoning,
- cognitive flexibility,
- language skills,
- a capacity for creative, divergent thinking,
- social competence, and
- engineering skills.

WOW!

There is also evidence that complex block-play is linked with higher mathematical achievement.

SUPER WOW!

How does it all happen? It's easy to see how stacking and arranging toy blocks could stimulate a toddler's motor development. But for other skills, it's likely that kids need to do more than simply move blocks around.

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Research suggests that kids benefit when construction play incorporates additional elements, including:

- building from templates,
- engaging in cooperative projects, and
- talking with others about spatial relationships.

Here is a review of the evidence, and some tips for enriching block play.

1. Toy blocks promote better spatial reasoning

We know there are links between spatial skills and construction play.

For example, when Yvonne Caldera and her colleagues observed the construction activities of 51 preschoolers, they discovered a pattern:

The kids who showed more interest in construction -- and built more sophisticated structures -- performed better on a standardized test of spatial intelligence (Caldera et al 1999).

The same pattern has been reported by others (Oostermeijer et al 2014; Richardson et al 2014; Jirout and Newcombe 2015). But of course we can't assume that block-play *causes* children to develop superior spatial skills. Maybe causation works the other way. Kids with advanced spatial skills may be more motivated to play with toy blocks!

That probably explains some of the pattern. Yet there is also good reason to think that construction play has developmental effects.

When researchers assigned kindergartners to participate in a program of guided construction play, these kids subsequently outperformed their peers on tests of spatial visualization, block building, and "mental rotation" -- the ability to rotate and analyze 3-D shapes in the "mind's eye" (Casey et al 2008).

And a more recent experimental study tested the effects of **structured block play** -- the sort of play we engage in when we reproduce a structure from a model or blueprint.

After a group of 8-year-olds participated in just five, 30-minute sessions of structured block play, they showed improvements in mental rotation.

In addition, brain scans revealed changes in the way their brains processed spatial information. Kids in a control group did *not* exhibit these changes (Newman et al 2016). Read more about it here.

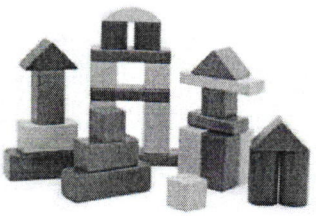
2. Structured block play may enhance cognitive flexibility

"Cognitive flexibility" is the ability to quickly shift your focus from one relevant stimulus to another. It's clearly important for success in school. But some kids struggle with it, and certain environmental factors -- like low socioeconomic status -- put children at higher risk for developmental delays. (We are a Title I school.)

Can toy blocks help? A recent experimental study suggests they might. Sara Schmitt and her colleagues randomly assigned some kids to engage in daily sessions of structured block play. In early sessions, the tasks were relatively simple (e.g., "build a tower"). But as kids became more familiar with the materials, they were given more demanding tasks (e.g., "copy the structure you see in this picture").

The researchers didn't observe any dramatic changes over time. But by the end of study, the kids who'd participated in structured block play showed improvements in cognitive flexibility, and this was especially true for children from families of lower socioeconomic status (Schmitt et al 2018).

3. Toy blocks are linked with language development



Might kids also get a language boost from construction play? That seems possible.

For instance, there is evidence that very young children develop better language skills when they engage in regular block play.

In a study sponsored by Mega Bloks, researchers gave blocks to middle- and low-income toddlers (Christakis et al 2007). The kids ranged in age from 1.5 to 2.5 years, and were randomly assigned to receive one of two treatments:

1. Kids in the *treatment group* got two sets of toy Mega Bloks--80 plastic interlocking blocks and a set of specialty blocks, including cars and people--at the beginning of the study. The parents of these toddlers were given instructions for encouraging block play.
2. Kids in the *control group* did ***not*** get blocks until the end of the study. The parents of these kids received no instructions about block play.

Parents in both groups were asked to keep time diaries of their children's activities. Parents weren't told the real purpose of the study--only that their kids were part of a study of child time use.

After six months, each parent completed a follow-up interview that included an assessment of the child's verbal ability (the MacArthur-Bates Communicative Development Inventories).

The results?

Kids in the group assigned to play with blocks

- scored higher on parent-reported tests of vocabulary, grammar, and verbal comprehension, and
- showed a non-significant trend towards watching less TV

It's not clear why block play had this effect. One possibility is that the children didn't really differ after all -- it was merely that parents in the treatment group perceived greater language competence in their children. Encouraging block play might have motivated them to pay more attention to their toddlers' development.

But it's plausible that parents in the treatment group spent more time talking with their children, which could explain the language gains. Children learn to talk by engaging in lots of one-on-one conversations with other people.

There is also evidence that kids develop an enriched understanding of spatial vocabulary when we talk with them about spatial relationships.

In one recent experiment, researchers instructed mothers to use relevant spatial language as they played with their 5-year-old children, and the effort made a difference: Kids exposed to this spatial talk were more likely to use spatial language themselves (Boriello and Liben 2018).

4. Toy blocks may stimulate creative, divergent problem-solving

Psychologists recognize two major types of problem. Convergent problems have only one correct solution. Divergent problems can be solved in multiple ways.

Because kids can put together blocks in a variety of ways, block play is divergent play. And divergent play with blocks may prepare kids to think creatively and better solve *divergent* problems.

In one experiment, researchers presented preschoolers with two types of play materials (Pepler and Ross 1981).

- Some kids got materials for convergent play (puzzle pieces).
- Other kids were given materials for divergent play (chunky, block-like foam shapes).
- Kids were given time to play and then were tested on their ability to solve problems.

The results? The kids who played with blocks performed better on divergent problems. They also showed more creativity in their attempts to solve the problems (Pepler and Ross 1981).

5. Cooperative construction play helps kids improve social skills

Research suggests that kids become friendlier and more socially-savvy when they work on cooperative construction projects.

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For example, in studies of children with autism, kids who attended play group sessions with toy blocks made greater social improvements than did kids who were coached in the social use of language (Owens et al 2008; Legoff and Sherman 2006).

And research on normally-developing kids suggests that kids who work on cooperative projects form higher-quality friendships (Roseth et al 2009).

6. Kids who are skilled with toy blocks tend to become better mathematicians

Block play has been linked with math skills, too. In one study, the complexity of a child's LEGO play at the age of 4 years had long-term predictive power: More complex play during the preschool years was correlated with higher mathematics achievement in high school, even after controlling for a child's IQ (Wolfgang et al 2001; 2003). YAY!

Other research has revealed links between a child's ability to recreate specific structures and his or her current mathematical skills (Verdine et al 2013; Oostermejier et al 2014; Richardson et al 2014).

And a study in the Netherlands found that 6th grade students who spent more free time in construction play performed better on a test of mathematics word problems (Oostermejier et al 2014).

Does this mean playing with toy blocks causes long-term enhancements in mathematical ability?

Not necessarily. But in the previously-mentioned experimental study of preschoolers led by Sara Schmitt, the researchers found evidence that structured block play improved mathematical ability as well as cognitive flexibility. This, at any rate, was the case for children from homes of lower socioeconomic status (Schmitt et al 2018).

Given the well-known link between spatial ability and mathematics achievement, it's plausible that structured block play could enhance math skills indirectly, via improvements in spatial reasoning.

7. Construction play helps kids develop engineering skills

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KEVA planks at the Long Island Children's Museum (image: LIWriter)

It's easy to see how construction play could teach valuable lessons about architecture and engineering. Builders who create small-scale structures must cope with the same laws of physics that constrain the design of bridges and cathedrals.

That's why engineers and scientists build physical models: It helps them test and explore their ideas.

Studies also suggest that students learn best about physical forces when they experience them first-hand (Hayes and Kraemer 2017). So if we want kids to develop an intuitive grasp of mechanical forces -- like the forces of tension and compression -- construction play offers excellent learning opportunities.

In one recent student, researchers taught 6th graders the principles of engineering through a hands-on program in the design and construction of earthquake-proof buildings (English et al 2017).

So it seems that toy blocks are an excellent educational investment. LEGOs appeal to many, but my personal favorites are these planks: KEVA Contraptions Plank Set, and KAPLA 200 Blocks Natural Unfinished Wood Pine Planks with Storage Bin and Guide Book.

These systems of identical planks have been featured as popular, hands-on exhibits in many science and children's museums. But beware -- building with them requires some dexterity, patience, and good humor. They topple easily, and may not be appropriate for young children who are still developing these skills.

Six tips: Getting the most from your toy blocks

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4. Introduce construction games that challenge kids to "match the design"

Research hints that a particular form of block play, called *structured block play,* may be especially valuable. This is when kids are shown the "blueprints" for a structure and given a set of blocks to recreate it. In recent experiments, 8-year-old children showed measurable improvements in their mental rotation abilities after just five, 30-minute play sessions. Post-training, they also showed changes in brain activity, suggesting that these kids had changed the way they processed spatial information (Newman et al 2016).

You can create your own sessions of structured block play at home with wooden blocks, interlocking plastic blocks (like Lego or Mega Bloks, Keva planks,Lincoln Logs, and Tinker Toys.

For the budding engineer, I also like the FoxMind Equilibrio Game, a set of 18 plastic blocks that come with 60 illustrations of structures to be erected. As the name suggests, part of the challenge is getting the structures to remain in balance, so concentration and fine motor skills are required.

And whatever your chosen medium, don't forget to keep up the conversation. "Match-the-design" construction games may be helpful, in part, because they stimulate spatial talk (Ferrara et al 2011).