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President's Paragraph: Notes from HASTI's President

Teaching in a Technology World

Dawn Bick

In each issue of The Hoosier Science Teacher, we invite the president to share some thoughts as an introduction. In this issue, HASTI's current President Dawn Bick offers her thoughts on the use of technology in the science classroom.

As a teacher, I know how many new techniques, strategies, and ideas get thrown at you from every angle. It's stressful and daunting. I hope that the technology ideas and strategies you're reading about in this month's Hoosier Science Journal are not dismissed or ignored. Teachers often struggle with new ways to use technology for a variety of reasons. We fear that we don't know enough about the technology to teach others. We are concerned that our students will use technology in a negative way. We feel these technology movements are fleeting and will pass. Teachers can navigate this new and uncharted experience together and positively.

I'm here to cheer you on and remind you that we are teachers because we value learning. For us to be good teachers, we need to be good learners. We must be willing to learn and utilize new and exciting ways to engage and reach our students. This generation has had technology in every moment of their lives. Technology is not going to disappear, whether we access it or not. Reaching out and embracing new ideas through technology keeps us fresh and engaged in today's world.

Students typically abuse technology when they don't have the knowledge and expectations about what is acceptable. Modeling and demonstrating how to use technology responsibly helps students know where the boundaries lie in using these resources. I encourage you to show students how to use technology and explain technology and explain why using technology in negative, disingenuous ways is detrimental to their learning.

Full listing of authors and contacts can be found at the end of this article.

Use technology in front of them. Talk through what you're doing, how you're thinking and share scenarios of the consequences of poor technology use.

Although different tools and aspects of technology are fleeting, the use of technology in education is not. Technology is and should be utilized for student engagement and to ignite teachers' imaginations to teach more effectively. Technology can be used to give us a fresh take on our content. It can be used to excite students that are hard to engage. We can use technology to differentiate learning for students at a variety of levels. Technology is forever changing and improving our lives. We do ourselves and our students a disservice when we don't use our resources wisely.

Ignoring technology will not make it go away. It is a tool that we use every day, be it our computers, phones or the alarm clock. Embracing how technology can be used in our world and classrooms allows us to be learners, gives us a chance to show students a positive way to use technology, and can be utilized in new and exciting ways to teach our students. I hope you try one of these new ideas this school year. Remember, we're all in this together. You're not alone! Reach out on HASTI social media and allow us to help each other.

See you in the digital world!

Author

Dawn Bick (dbick2023@gmail.com) is the 2024-25 HASTI President, and she the STEM Program Specialist at the Girl Scouts of Central Indiana, Indianapolis, IN, USA.

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Join Us at the 2025 HASTI Conference: Embracing the Future Together

Craig Williams

Abstract
On behalf of the HASTI Board of Directors, 2025 HASTI Conference Chairman Craig Williams shares some information about the theme and plans for the next HASTI Conference at Noblesville High School, February 15-17, 2025.

The conference committee has been busy putting together the 2025 HASTI Conference, Embracing the Future Together, at Noblesville High School on February 15-17. A few months ago, we asked for proposals related to the future: the future of science teaching, the future of sustainability, the future of STEM, the future of cross-curricular instruction, and the future of literacy in the science classroom.

We asked, and did you ever answer! Talk proposals came in covering these strands from almost every angle possible. Attendees at the 2025 HASTI Conference will be able to learn about…

- Using biotechnology, aquaponics, and more to solve global agricultural problems
- Exploring alternative energy sources such as tidal power and biofuels
- Using unique cross-curricular pedagogical approaches, such as place-based learning, STEM travel, service learning, and Project Based Learning
- Integrating children's literature and science fiction into the science classroom
- Teaching students how to detect misinformation and think critically about big issues such as climate change
- Using techniques such as gel electrophoresis and the study of environmental DNA
- Teaching students about computer science, data literacy, and AI
- And much, much more!

We are excited about a new opportunity this year: the Purdue K-12 Science Outreach Team is putting on a workshop entitled "Gamification in the Science Classroom: Let's have some fun!" There will be an orientation session, followed by a game playing session. The other part of the day participants will attend concurrent HASTI sessions. Then, these teachers will receive board games to take with them back to their classroom! You can sign up for this workshop when you register for the conference, and you can do this workshop either Sunday morning or afternoon, or Monday morning or afternoon.

There are also two field trips you can choose when you register. On Saturday, you can go to the Girl Scouts STEM Experience Center and experience their Virtual Motorsport Racing Simulator. You will design aspects of the vehicle, then test drive it on a virtual track. On Monday afternoon, we bring back a past favorite: the IU anatomy lab tour. On this field trip, you can learn about the cardiovascular system and the digestive system, as well as their use of Advanced 3D Touch technology.

Finally, we will have sessions for participants to interact with each other, visit the exhibit hall, meet in discipline-specific sections meetings, and attend share-a-thon sessions in both physical and life sciences. Bring your own board game night is back, on Sunday at our conference hotel, Courtyard at the Marriott. On Sunday we will hear from Purdue geophysics professor Andrew Freed, and on Monday we will celebrate the recipients of HASTI awards.

Full listing of authors and contacts can be found at the end of this article.

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Registration for the conference is open at hasti.org, and if you require hotel accommodations, you can find hotels with group rates at the bottom of the registration page. Remember, the conference itself will be at Noblesville High School. We hope you join us in February as we Embrace the Future Together!

[Click HERE to Register for the 2025 HAST Conference]

Author

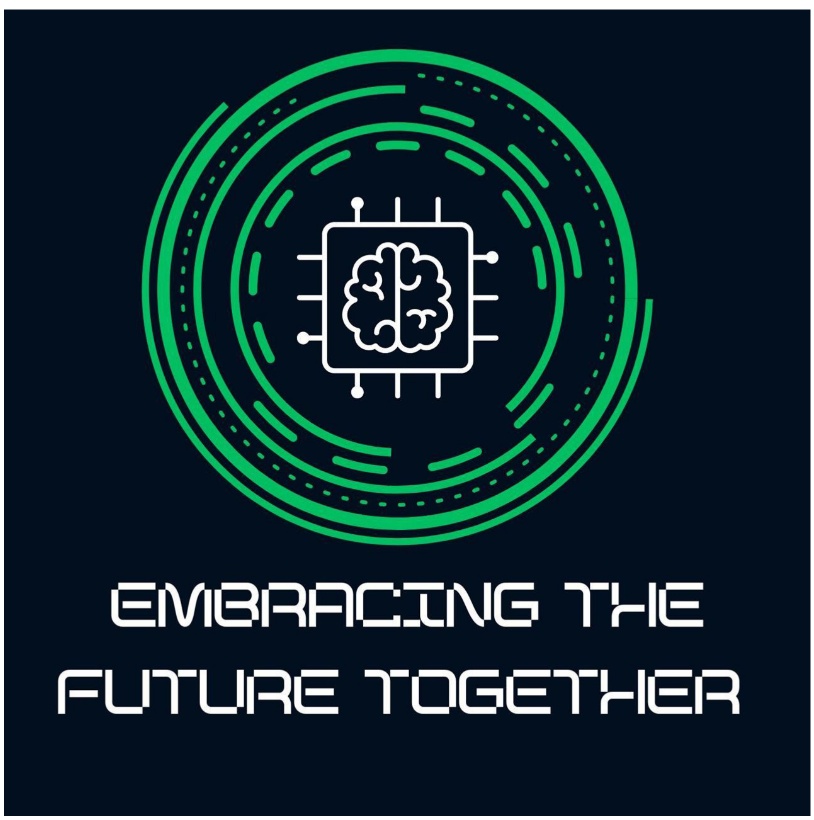
Craig Williams (craig.williams@nwesc.k12.in.us) is the current Past President of HASTI and will chair the 2025 Conference. He teaches Physics at Northwestern H.S. in Kokomo, IN.

2025 HASTI Conference

Embracing the Future Together.

February 15-17, 2025

Noblesville High School



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Opinions: Educators' Thoughts on AI in the Classroom

Editor's Note:
We reached out to HASTI members and asked for their thoughts on artificial intelligence in the classroom. The prompt was purposely broad to encourage varied and creative responses. We want to thank the people who responded to the call. We hope you will agree that this is an important conversation to have, and these authors have provided us with a good place to begin.

Embrace the Change

Dawn Bick, STEM Program Specialist, Girl Scouts of Central Indiana and current HASTI President

Whether you've been in the classroom for less than a year or for more years than you want to count, technology is changing as quickly as it is introduced. Let's embrace the change as willingly as we embrace a new phone with new features. We're not afraid of the phone and learning what the new buttons do. We're excited and eager to learn and teach others. As it should be with new versions of technology, such as AI (Artificial Intelligence).

I openly admit that I was afraid of AI. I had visions of robots teaching my class and my role being diminished. Movies played in my mind of destruction and peril. However, after taking an online class on AI, I've changed my mind. I have used what I learned in that class many times and I have some ideas and suggestions on ways you can navigate this new territory.

Start small. I learned to begin small. Using AI can be as simple as generating a variety of words to make your newsletters and emails more engaging. When I am stuck with another way to express my thoughts, generating an AI thesaurus can remind me of meaningful phrases to use.

Use what is already available. Have you noticed the pre-empted email responses available when you go to reply to an email? Consider using them. They are created based on your history of responses and can often make your correspondence interesting and concise. It saves you time and energy. Our mental capacity is better spent on engaging activities and exciting our students.

Embrace a fresh start. New ideas are sometimes difficult to come up with and daunting to execute. AI can give you a new perspective on a lesson. It can suggest a game or activity that may put a new spin on your lesson. When struggling to find resources to differentiate for students, AI can give ideas to bridge missing content or extend a student's knowledge to new heights.

You may be asking; how do I get started? I like to use Gemini. I don't have to have an account or sign in. I just open the website, type in

"Generate a game to teach the food chain", and I get the following ideas in seconds:

Food Chain Game: "Eat or Be Eaten"

Objective: To create a balanced food chain by correctly matching organisms as predators and prey.

Materials:

- Picture cards of various organisms in a food chain (e.g., plants, herbivores, carnivores)
- Large game board with spaces for each type of organism

Setup:

1. Shuffle the picture cards and place them face down in a pile.
2. Place the game board in the center of the playing area.

Gameplay:

1. Turn-Taking: Players take turns drawing a card from the pile.
2. Card Matching: The player must place the card on the game board in the correct position within the food chain.
    - If the card is a producer (plant), it goes at the bottom of the chain.consumer.

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- If the card is a consumer (herbivore or carnivore), it goes above the organism it eats.

3.Correct Placement: If the player places the card correctly, they keep the card.

4. Incorrect Placement: If the player places the card incorrectly, they return it to the bottom of the pile.

5.Winning Condition: The first player to create a complete and balanced food chain, from producer to top predator, wins the game.

Additional Tips:

- Difficulty Levels: Adjust the game's complexity by including more or fewer organisms or by using more complex food webs.
- Educational Extension: After playing the game, discuss the roles of different organisms in the ecosystem and the importance of maintaining a balanced food chain.
- Creative Variation: Create a collaborative version where players work together to build a food chain, discussing and debating the correct placement of each organism.

Example Food Chain:

- **Producer**: Grass
- **Primary Consumer:** Grasshopper
- **Secondary Consumer:** Frog
- **Tertiary Consumer:** Snake
- **Quaternary Consumer:** Hawk

By playing this game, children can learn about the interconnectedness of organisms in an ecosystem and the importance of energy flow through the food chain.

Other websites such as Grammarly, Semrush, Figma, and Wordtune can be helpful as well. Images can be found using AI such as Deep AI, Opera, and Open Art.

Our minds and creativity are only limited by the resources we are open to using. I want to encourage and support you in finding AI and other technology as exciting and new. Be as excited about using technology in your classroom as you are when you get a new feature on your phone. And when it doesn't work out the way you expected, be open and honest about it. Be a model for your students about how to be resilient when our efforts don't produce what we intend. These are wonderful learning opportunities for you and your students that don't occur in a textbook and can create a lasting impact.

Thoughts on AI in Education

Kelly Book, Earth-Space Teacher, North Harrison High School

This summer, I attended a Nextech workshop titled "Incorporating AI in your K-12 Classroom". My initial thoughts on AI reflected that of many of my colleagues. All I could think about were those students who used AI to generate essays or responses to online assignments. I recently overheard a student say "I'm just going to 'GPT' it" so that they could get out of writing an essay assignment that they did not understand.

However, the more I learned from the Nextech workshop, the more I realized that AI is used pretty frequently in our daily lives. In the workshop, we discussed how asking Siri a question, using an online translator, and adding a filter to your face on Snapchat are all examples of ways people have unknowingly used AI. Another fact that surprised me was that AI has been around since the 1950s. Alan Turning developed a code breaking machine for the British government during WWII, and John McCarthy conceived the term Artificial Intelligence in 1956 (Haenlein and Kaplan, 2019). I also learned that machine learning is a part of AI and a way to train a computer into recognizing certain features (Chiu, 2024). In the workshop, I got to engage with **Code.org's "AI for Oceans"** program, which runs through a lesson of machine learning. There were also other great resources I learned about such as **remove.bg**, which my students recently utilized on a Canva assignment to remove the background from an image. Some other fun ways Google has to incorporate AI in the classroom are **Quick, Draw, Say What You See**, and **Teachable Machine**. < >

I have changed my opinion on AI since I have attended the Nextech workshop. Yes, there will always be those students who use it to cheat on assignments, but those students will always find a way to cheat. There are so many other applications for AI. I asked a couple of students how they use AI to learn, and I got some enlightening responses. Both students essentially said that if they get stuck on a problem or a definition, they will use AI to give them a starting place or a better understanding of the material. It can simplify complex terms or break down problems step by step with explanations. AI might not always have perfect responses, but it can provide students with a starting point. As educators, it will be challenging to keep up with new innovations, but evolving technology such as AI is here to stay. We must find a way to embrace these changes and adjust.

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Deliberate Use of AI in My Science Classroom

Tina Harris, Bedford-North Lawrence High School

First, I would like to point out that I love computers. I had an Apple IIc, a first gen Macintosh (when they were still referred to by that name), a new computer every time they added 250 KB to the hard drive until things changed to MB, then GB, then TB (my current gaming laptop). I ran the school newspaper and taught kids how to edit photos, use MS Publisher, use digital cameras effectively, shoot short videos – I have been there since the beginning. I was on social media when it was text based IRQ and was familiar with how to navigate MS-DOS. I am not a Luddite. And I do not use AI for anything but spell checking, search engines, and occasionally to check a report to make sure it is original (I do not assign a lot of research anymore). I am currently on the technology committee for my building, and they all wonder why I am there because of my current non-use of AI.

I have reasons for not using AI, some of which might make sense. First, AI still has a LOT of bugs that need to be fixed before it is an effective tool. People with mismatched eyes or seven fingers are just creepy. Second, definitions for science terms that have nothing to do with science and students who are unable or unwilling to evaluate the information provided for them from such a "powerful" source. Third, source materials that reference other AI generated articles that reference non-existent prior sources. These all rank rather high on my reasons for dislike and distrust list.

I remember that we were told, way back in the day, that the use of calculators would make math accessible to more students. This would allow us to work efficiently and cover more material in both math and in science classes. And that actually works for students who understand how math works, the rules for rearranging components of an equation to make it simpler, the fact that an answer should be within a certain range because they can multiply or even add easy numbers to see if their final answer is close. But for students who have never learned multiplication tables (they understand number relationships, sequences, and patterns) even the simplest science equations for speed or force make absolutely no sense. It's all Greek to them. Students who learned math without calculators seemed to learn more number theory and it was easier to teach them relationships than the students I see today. I wonder how the use of AI will affect the ability of students to think for themselves verbally? Will it have the same effect as calculators seem to have had numerically? Will they lose the ability to formulate sentences and analyze statements that make sense without the computer to do it for them?

Finally, as should have been obvious in my introduction, I am of an age where I have been told I need to exercise my mind – use it or lose it. I have no problem writing coherent statements that say what I want them to say. I have no problems writing higher level questions. I do not need my computer to plagiarize someone else's publicly posted homework which may or may not address the topic or skills I want to see my students address. I have my own "database" of information I have collected over the decades to draw from. I am not saying I do not use the internet to look for lesson ideas or an occasional worksheet when I am too busy or too ill. But I do not ask the computer to generate it, and I put sources in the footer when I borrow someone else's work so others

AI does not encourage educators or student to practice critical thinking skills. Everyone sees it as a tool to make their lives easier. But a hammer is also a tool, and you do not use it to fix every broken item in a house! Both educators and students need to learn how to use this tool responsibly and for the right reasons – not to replace thinking but as a starting place to enhance thinking. And I do not see that happening right now. I see it "hammering" schools in the same way cell phones have – irresponsibly and overwhelmingly. Honestly, I would rather use Wikipedia as a source, at least it references where the information originated.

I believe the crux of the matter with the use of AI is, who is doing the thinking? What are their goals? What is their reliability and validity? And how does that help me to expand my skill set and put conscious thought into the materials or questions being suggested or used? Where and to what am I relinquishing my responsibilities as an-educator and teacher? And how can I teach students to think critically using AI as a tool instead of leaning on AI as a crutch to replace deep thought? How do we keep AI from affecting our classes in the same way cell phones have?

I realize the purpose of this conversation is to look at all these questions – how and when do we use AI, how do we teach our students the same? Sadly, we cannot put this genie back into a bottle. And I do not have any answers. I may be putting my head in the sand by not dealing with this. By dumping this AI product on the market, the way technology companies did they are using all of us as guinea pigs. My students just don't see it, no matter how many times I talk to them about the inconsistencies and misinformation they are bringing to my class. It's a new toy to save them from the work of thinking.

My answer to using AI is, don't. Work around it. Fight to educate students on the importance of personal critical thought and creativity before the laziness of using AI overwhelms them and thinks for them – before it becomes a tool of propaganda as it so easily can. And teachers should be aware of the same – it would be easy for someone to control the algorithm in such a way as only certain lessons are available and only certain questions are asked. Look at how social media has done so. Only then would I be willing to use AI in my classroom.

Okay, maybe I am a paranoid Luddite when it comes to this particular innovation. I do not apologize; I think, and I try to teach others to do the same.

Artificial Intelligence in Education

Robyn Embry, Science Teacher, Mitchell High School

Earlier this year the Indiana Learning Lab published a guidance document for educators focused on the use of Artificial Intelligence (AI) in education, providing an easy to unpack resource that is built on the work of experts in the field (Indiana Department of Education, 2024a). The AI Guidance Document is introduced by the Indiana Learning Lab in a 15-minute webinar (Indiana Department of Education, 2024b), which provides an excellent overview of AI and its potential use in education. The five sections of the guidance document can each serve as the start of a conversation on a specific aspect of AI: AI Literacy, Instruction and Learning, Impact, Security, and Resources, each of which is summarized below.

AI Literacy

AI literacy is defined as the "knowledge, skills, and attitudes associated with how AI works, including its principles, concepts, and applications, as well as how to use AI, such as its limitations, implications, and ethical consideration" (Indiana Department of Education, 2024, p.1). The Digital Promise (n.d.) AI Literacy Framework breaks AI literacy into three parts:

1. Understanding AI: What is it? How is it trained? What are the different types of AI?
2. Using AI: How do we interact with it? How can we use it? How can it solve real world problems?
3. Evaluating AI: How can we be aware of how AI is being used? What information are we sharing? What are the benefits and risks of using AI?

Instruction and Learning

The power of AI can be harnessed to enhance the connection between teachers and students by supporting the work educators do to plan and implement lessons and wielding it as a tool used with and by students Educators might use AI to create content, design assess ments, aid in differentiation, assist with feedback, or enhance personal learning. For students, AI might spark creativity, be used as a one-to-one tutor, help with collaborative processes, provide personalized communication, or give feedback. These possibilities presented by AI are generalized into three categories according to the primary way they enhance work done by educators and students: personalized learning, time, and feedback. These three categories are applicable to students as well as educators.

Impact

The impact of AI is an ongoing discussion. Regardless of the paths students take after leaving the k-12 educational setting, they will be interacting in some capacity with different forms of AI. The AI Guidance Document provides examples of how educators and students can apply AI technology in their lives and careers in a healthy and ethical way.

Security

Security considerations for the use of AI in policy and practice is increasingly vital due to the potential for cybersecurity breaches. Educators are encouraged to implement practices such as ensuring that inputs into public facing AI tools are free from personal identifiable information, verifying that students are using AI tools approved for their age range, and engaging parents and caregivers in learning how to talk with students of all ages about safely using AI tools.

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Resources

The AI Guidance Document provides links to organizations that are leading conversations about AI in education and resources that have been created to support educators in the rapidly changing environment that surrounds and encompasses AI. The Indiana Learning Lab has additional resources, webinars, and ideas to assist educators who are using AI to enhance learning.

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Pre-service Teacher Reflections on AI

Shelly Engle, Director of Teacher Education & Assistant Professor of Education- Taylor University

In a teacher education course, Educational Technology in Elementary Education, preservice teachers complete a module on Artificial Education in the Classroom as a part of their curriculum. An introductory assignment asks these four questions for reflection after a teaching session on using AI in the classroom as a teacher:

- **What do you know about AI in Education?**
- **What has been your exposure to using ChatGPT or other AI?**
- **What are you concerned most about?**
- **What are you most excited about?**

Provided below is a summary of their assignment responses as compiled by ChatGPT (OpenAI, 2024).

- **What do you know about AI in Education?**
  Most respondents acknowledge having limited knowledge or experience with AI in education. They are aware of its potential as a tool for lesson planning, idea generation, and simplifying tasks, but it is often viewed through a negative lens, particularly as a means for cheating or unethical behavior. Many associate AI with restrictions set by teachers or schools.
- **What has been your exposure to using ChatGPT or other AI?**
  Exposure ranges from minimal to moderate, with most respondents using AI for brainstorming, gener ating ideas, or simplifying information. Few haveexplored advanced functionalities. Many students mention hesitation or avoidance due to fear of misuse or unclear guidelines.
- **What are you concerned most about?**
  Common concerns include:
  - AI being misused by students for cheating or avoiding learning.
  - Over-reliance on AI leading to a loss of critical thinking and creativity.
  - Ethical and reliability issues, such as inaccuracies or the overwhelming amount of data AI provides.
  - Broader societal implications, like job displacement and reduced human effort in creative tasks.
- **What are you most excited about?**
  Respondents are excited about AI's potential to:
  - Enhance creativity and lesson planning.
  - Save time on mundane tasks, allowing teachers to focus on instruction.
  - Generate new, engaging educational activities and accommodations.
  - Foster collaboration and communication, especially for language learners or special needs students.
  - Expand learning opportunities and introduce innovative ways to engage students.

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Using Generative AI to Reimagine the Scientist: A Case Study in Preservice Science Education

Terri Hebert, Associate Professor, Science Education, Indiana University South Bend

In a senior-level science methods course for pre-service educators, the Adobe Express text-to-image AI feature has been integrated into an adaptation of the classic Draw-a-Scientist Test (DAST). Originally developed in 1983 to explore children's perceptions of scientists, DAST often revealed stereotypical images of white men in lab coats and pocket protectors. This course-based iteration aims to help adult learners document their transformation as they begin to see themselves as scientists. By using AI to create their depictions of scientists, students engage in a novel process that transcends artistic skill, relying instead on descriptive language to guide the generative technology. The exercise is conducted twice – once at the start of the semester and again at its conclusion – allowing for a visual and conceptual comparison of their evolving perceptions.

One of the most striking findings of this activity is the removal of artistic limitations. Students no longer dismiss their efforts with "I'm not an artist," as the AI creates images based on their written or verbal descriptions. This democratization of expression lets them focus on the essence of their ideas rather than the medium. At the semester's outset, many students provided stereotypical descriptions, which the AI translated into traditional scientist imagery. However, by the semester's end, their descriptions and the AI-generated images began to reflect a broader and more personal understanding of what it means to be a scientist. Importantly, this shift began earlier than in traditional DAST studies and documented nuanced changes throughout the semester, thanks to the AI's ability to generate precise visualizations.

After three semesters of incorporating this activity, consistent trends have emerged, with one noteworthy exception. In the most recent iteration, the students' final images prominently featured elements of a nature-based, outdoor approach to science – aligning with the semester's emphasis on experiential, field-based scientific practices. This outcome suggests that the integration of generative AI not only captures but also amplifies the pedagogical focus of the course. By making the invisible process of identity transformation visible and tangible, this innovative use of technology offers a powerful tool for fostering self-identification as scientists among future educators.

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Column: Elementary Explorations
Using Technology with Young Children

Kristen Poindexter

Abstract

Using technology with young children can be intimidating and many teachers are unsure where to begin. This ariticle shares several ways that teachers can incorporate technology into their classrooms, while teaching young children to appropriately use and care for the technology. Students can also begin to learn basic coding schemes and several are shared.

December and January offer so many opportunities for young children to explore technology. Beginning during Hour of Coding week in December, I introduce a new form of technology to my kindergarten students every few days. Each of the options I share with them will remain out in the classroom for the remainder of the school year. Through grant writing, I have been able to build up a collection of several different coding bots. We use them to engage in seasonal activities as well as to tie to several Computer Science standards.

I currently have a set of 8 Ozobot Bits and in addition to teaching my students how to use them and code them. I also teach them how to care for them, charge them, and develop their own activities using other materials in our classroom. I begin by teaching the different color markers that Ozobots are able to recognize (red, blue, black, and green) and how to make thicker lines that the Ozobots will be able to read. We test out all kinds of lines to determine which width the lines need to be and then practice how we can make them with markers in our classroom. We also learn that the lines need to be spaced enough apart from each other so we do not confuse the Ozobot (Figure 1).

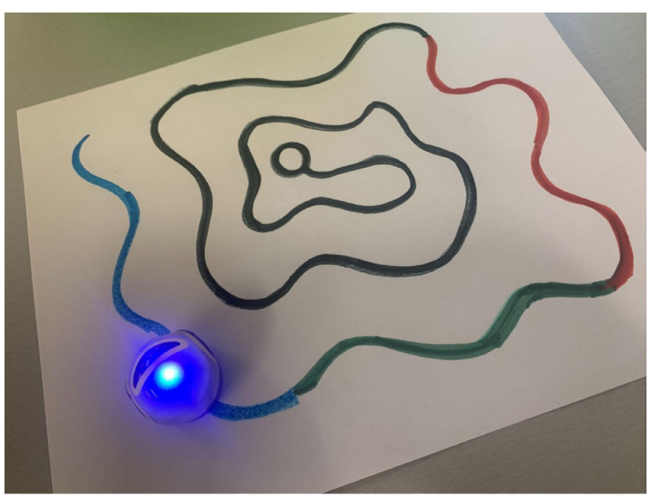

Figure 1. Ozobot Bits

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I will then show students some of the coding schemes (https://ozobot.com/create/color-codes/) and we practice the color codes by having reindeer races (lesson and reindeer templates: https://ozobot.com/educate-3/lessons/). Students are given a long sentence strip and create a race track that will help their reindeer win the reindeer race (Figure 2). They can choose color codes that will help their reindeer go faster, backwards, get a turbo boost and more! This helps students learn some basic color codes and how to use them to their advantage. K-2.PA.3: Develop programs with sequences and simple loops to express ideas or address a problem.

We also use the Ozobots to play a Hanukkah dreidel game. The lessons can be found on the Ozobot website. For this game, the children need to practice the color codes to help their dreidel spin and spin in the correct space so they are able to take more gelt from the pot. We use math cubes or mini-erasers as our gelt (Figure 3).

Figure 2. Ozobot reindeer races

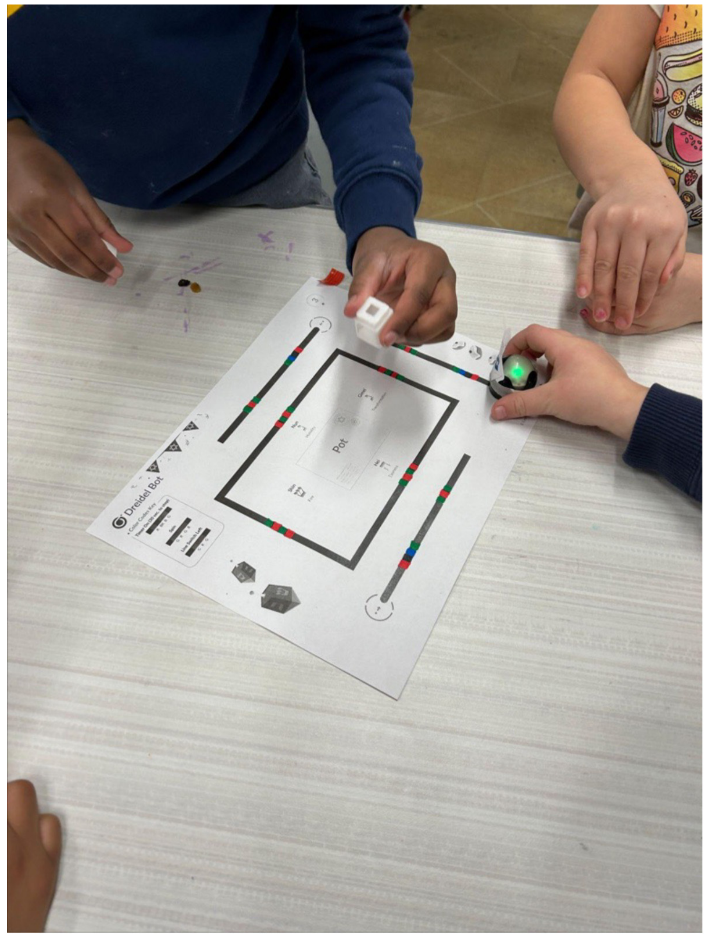

Figure 3. Dreidel game

The next type of robot that we use are called Beebots. They are perfect for younger students because they are larger and because they are easy to program. There are several simple buttons on the top of each Beebots that allows students to code the direction they want the Beebots to go. I show students how to move the Beebots forward and backward and then left to right. We also learn how to program a sequence to help the Beebot get from one place to another with accuracy. The standard K-2.PA.1: Breakdown and plan the order of the steps needed for a desired outcome to accomplish the goal, helps children accomplish this task. I purchased several BeeBot mats, but have also created my own mats out of shower curtains (Figures 4 and 5). One problem with the shower curtains that we have discovered, is that the squares are not aligned with the length that the BeeBot moves in any one direction. Before creating your own design, measure the length that your BeeBot moves forward, backward, left, and right so that your students can code the bot appropriately.

Figure 4. Beebots and letters mat

Figure 5. Beebots and park mat

Author

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Help Your Students Become DataWISE with NCSE's New Tool

National Center for Science Education

Abstract
Are you frustrated with the misinformation you see daily in the media? NCSE is excited to share our new DataWISE tool that combines science practices and media literacy skills into a coherent framework for critically analyzing data-based claims.

Reprinted with permission from the National Center for Science Education.

What Is DataWISE?

Are you frustrated with the misinformation you see daily in the media? Looking for new ways to engage students in applying scientific reasoning to everyday issues? Hoping to integrate media literacy into your curriculum, but not sure where to begin? NCSE is excited to share our new DataWISE tool that combines science practices and media literacy skills into a coherent framework for critically analyzing data-based claims.

WISE represents four key aspects of data literacy — three questions and one action — that should be considered when we encounter a claim that requires scientific information to support it:

W - Is this worthy of attention.
I - Inspect the data.
S - Does this make sense?
E - What emotion is activated?

We like that the acronym spells wise, which reminds students of the importance of using good judgment. However, the order of the WISE steps is intentional. When we are doing science, we are always asking one key question: Is the claim supported by evidence? The Inspect and Sensemaking steps focus on data analysis to support claims - a critical science practice. When we encounter claims in everyday life, we have to be careful though. Not everyone is playing by the rules of science, so we need to consider potential motives, bias, mistakes, and appeals to emotion with the Worthiness and Emotion steps.

"DataWISE is a tool that scaffolds key science practices and media literacy skills to guide students in critical analysis of data-based claims." (NCSE)

Access DataWISE

Full listing of authors and contacts can be found at the end of this article.

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Open Access

A Preliminary Analysis of Indiana Schools' Implementation of Virtual Instruction and CS Education in the 2020-2021 School Year

Lu Wang[1] and Carter Adkins[2]

Abstract
This study analyzed two datasets published by the Indiana Department of Education (IDOE) related to implementing virtual instruction and computer science (CS) education in Indiana schools during the 2020-2021 school year. The research explored schools' virtual instructional practices amidst unprecedented educational disruptions and the preparedness and execution of CS curricula. Using quantitative and qualitative methods, we first evaluated the distribution of different instructional modes, school districts' adoption of virtual instruction, their support mechanisms for students, successes, and challenges schools experienced, and their future plans for virtual learning. The findings reveal that hybrid and virtual instruction were prevalent, yet disparities in technology access and instructional quality persisted. Schools reported barriers related to technology resources, teacher preparedness, and student engagement. Additionally, this study highlights the inequities in implementing CS education, particularly at lower grade levels, underscoring the need for increased resources and teacher support. These insights aim to inform future educational strategies for multi-modality instruction and enhance the integration of CS education into K-12 curricula.

Keywords: *Virtual instruction, Computer science education, Indiana schools, Technology access, Teacher support*

Virtual Instruction

Due to the global pandemic, U.S. public schools transitioned to distant learning in March 2020. In Indiana, the Governor issued an order to close all public schools, initiating remote instruction on Mar 19. School buildings remained closed for the remainder of the Spring semester (Decker, Peele, & Riser-Kositsky, 2020; Herron, 2020). By the Fall of 2020, some in-person instruction resumed, but most Indiana schools adopted a hybrid model due to frequent school closings. A virtual option was offered for students who were sick or in quarantine. These patterns continued in the Spring semester of 2021.

Teaching with educational technology at the pre-college level has been prevalent since the 1990s (Means & Olson, 1997). With the development of technologies, various tools have been found to be effective in supporting K-12 students' learning. For example, visualizations make abstract phenomena and concepts visible, educational games promote student active engagement, and simulations make traditional labs more accessible (Chien, Hwang & Jong, 2020; Hao, Zhen, Wang & Jiang, 2021; Wang, Hodges & Lee (2022). Before 2020, most classroom technologies were integrated into in-person instruction, where students typically worked individually or in groups while interacting with these tools. However, due to the pandemic, more than two-thirds of school districts in the U.S. employed a hybrid model that included both in-person and virtual instruction (Herold, 2021). This abrupt shift highlighted the critical role of technology integration in shaping student learning outcomes.

While several studies have examined the learning experiences of college students during the year 2020-2021, few have investigated how K-12 schools accommodate the virtual, technology-rich learning environment during the pandemic (e.g., Barrot, Lienares, & Del Rosario, 2021; Muhammad & Srinivasan, 2021; Tan, 2021). This study seeks to address this gap by examining the virtual instructional practices Indiana K-12 public schools implemented during the pandemic in the 2020-2021 school year.

Full listing of authors and contacts can be found at the end of this article.

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K-12 Computer Science Education

There is a growing global awareness of the importance of computer science (CS) education. Integrating CS courses into the K-12 curriculum emphasized the need to prepare current students to transition from technology consumers to becoming technology creators (Yadav, Gretter, Hambrusch, & Sands, 2016). In Indiana, state requirements mandate that, after June 2021, all public schools include CS in the curriculum for K-12 students (IDOE, 2018). However, little is known about schools' readiness for CS implementation. Research has found that CS curriculum design is a complex task, as there is no single commonly accepted theory to guide the vision for the CS curricula (Pacheco, 2012; Webb et al., 2017). Therefore, understanding schools' current implementation of CS curriculum can provide valuable insights into the support needed for schools and teachers.

Research Objectives

This manuscript focuses on two primary objectives: 1) to examine the virtual and hybrid instructional practices implemented by Indiana K-12 schools during the 2020-2021 school year; and 2) to investigate schools' implementation of CS education at K-8 levels during the same period. The following research questions guided our study:

1. What modes of instruction did Indiana schools adopt during the 2020-2021 school year?
2. How did the public schools in Indiana support students' virtual learning during the pandemic?
3. What barriers and successes did schools experience with virtual instruction?
4. What were the schools' practices for implementing CS curricula at K-8 grade levels?

Methodology

Data Source

This study utilized two datasets obtained from the Indiana Department of Education (IDOE) website: Dataset #1, Modes of Instruction, and Dataset #2, Technology Plan. Both datasets were accessed in July 2022. Dataset #1 provides information on the percentages of weeks during which schools adopted virtual, hybrid, and in-person instruction as their primary modes. The IDOE collected this data on July 9, 2021. Dataset #2 contains responses from school districts regarding their use of technology and the implementation of CS instruction during the 2020-2021 school year. The dataset includes both multiple-choice questions (e.g. "Did your school/district upgrade its on-campus bandwidthin response to COVID?") and constructed response questions (e.g. "Describe any barriers you face when implementing virtual learning days and describe how they impact your decision to implement (or not implement) virtual learning days?").

Data Analysis

We used both quantitative and qualitative approaches to analyze the data. For the Modes of Instruction dataset (Dataset #1), we first grouped schools by county and calculated the average percentages of each instruction mode for every county. We then coded each county's primary instructional mode.

- In-person counties: counties where over 67% of schools conducted in-person instruction for more than 90% of the total weeks.
- Virtual counties: counties where more than 50% of the schools employed virtual instruction for over 50% of the whole week.
- Hybrid counties: counties not falling into the above two categories.

To address research questions 2, 3, and 4, we analyzed school districts' responses to 47 relevant questions from the Technology Plan dataset (Dataset #2). We present a summary of the analyzed questions, and the methods applied, in Table 1.

Table 1. Survey Questions and Data Analysis for Dataset#2

Topic	Questions	Analysis approaches
Virtual/hybrid instruction environment	1. 1:1 technology status 2. Amount of synchronous and asynchronous instruction 3. Percentage of purchased digital content in the curriculum	Quant analysis
Support for virtual learners	1. Percentages of students who do not have broadband internet access at home in each school district. 2. Ways that school districts support those who do not have internet access at home. 3. Staffing approaches for virtual learners.	Quant analysis
Barriers and successes	1. The barriers schools faced when implementing virtual and hybrid instruction. 2. The biggest successes schools experienced during the virtual and hybrid instruction and specific strategies they used to engage students	Qual analysis
Future plans	1. Advances made that will endure in the future 2. The top three PD goals identified in the next three years.	Qual analysis
*CS implementation	1. Do your students receive standards-based computer science (CS) instruction? 2. CS implementation strategy. 3. Where does the majority of CS instruction take place? 4. Who delivers the majority of CS instruction?	Quant analysis

Note: These same set of questions were asked for all grade levels.

Results

Modes of Instruction

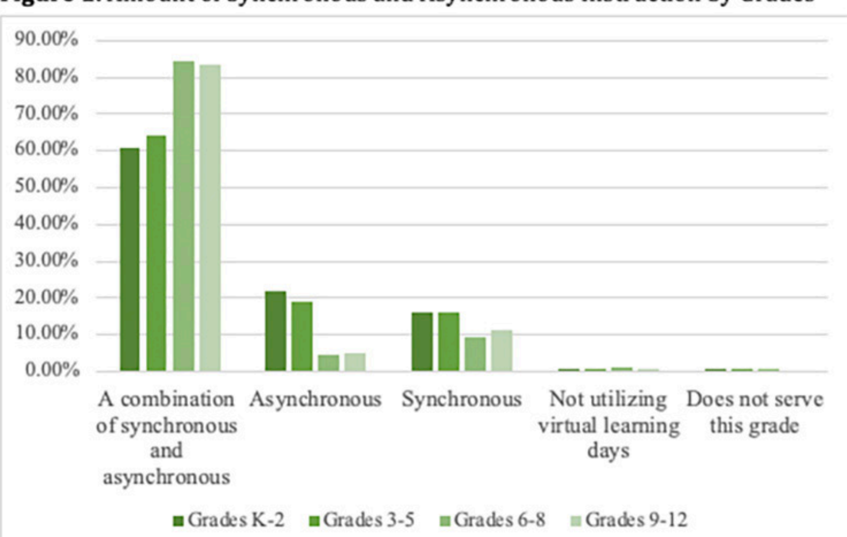
Table 2 summarizes the modes of instruction adopted by counties. The number of counties with in-person as the primary mode (48) is similar to those counties› employing hybrid as their primary mode (42). Only one county fell into the category of virtual. When mapping the locations of hybrid and in-person instruction across the state, we observed that schools in the northern region predominantly adopted in-person instruction, whereas more counties in the southern region implemented hybrid instruction.

It is important to note that counties were categorized as in-person if over 67% of the schools within them conducted in-person instruction for more than 90% of the weeks throughout the year. Additionally, within Dataset #1, schools were labeled as "in person" when their in-person attendance rate reached 75% on specific days. This classification means that even in counties coded as in-person, over 30% of schools may have implemented hybrid or virtual instruction, with up to 25% of their students attending virtually. As such, hybrid or virtual instruction was present in nearly every school in Indiana during the 2020-2021 school year. Understanding how schools managed these modes of instruction becomes essential. The findings related to hybrid and virtual instruction are discussed below.

Table 2. Mode of Instruction

Category	Category definitions	No. of Counties
In-person	Over 67% of schools in this county adopted in-person mode over 90% of the weeks.	48
Virtual	Over 50% of the schools in this county adopted virtual or hybrid mode for more than half of the total weeks.	1
Hybrid	Remaining schools	42

Figure 1. Amount of Synchronous and Asynchronous Instruction by Grades



Virtual/hybrid Instruction Environment

To understand the virtual and hybrid instruction environments, we analyzed school districts' responses to questions about their one-to-one (1:1) technology status, the amount of synchronous and asynchronous instruction during virtual learning days, and the percentages of purchased digital content in the curriculum.

A one-to-one technology district is defined as one that provides students with computing devices for learning at school. Among the 291 public school districts, 90.69% achieved 1:1 technology status across K-12. Approximately 2.4% did not provide devices, while the remaining school districts provided devices starting at a higher grade, such as 1:1 technology only for middle and high school students. Notably, of schools with 1: 1 technology, 23 (about 8.7% of them) did not allow students to take their devices home.

We also analyzed the amount of synchronous and asynchronous instruction during virtual learning days across grade levels (Figure 1). Most school districts implemented a combination of both synchronous and asynchronous approaches.

Instructional materials need to be adapted into digital formats to accommodate virtual learning. Our analysis revealed that 141 out of 291 school districts purchased less than 30% of their digital content, while sixty-five schools purchased over 50% of their digital content (Figure 2). However, this survey question only asked about the percentage of school-purchased digital content. Consequently, the exact total amount of digital content used remains unclear, as schoolteachers may also digitalize materials.

Figure 2. Percentages of Purchased Digital Content

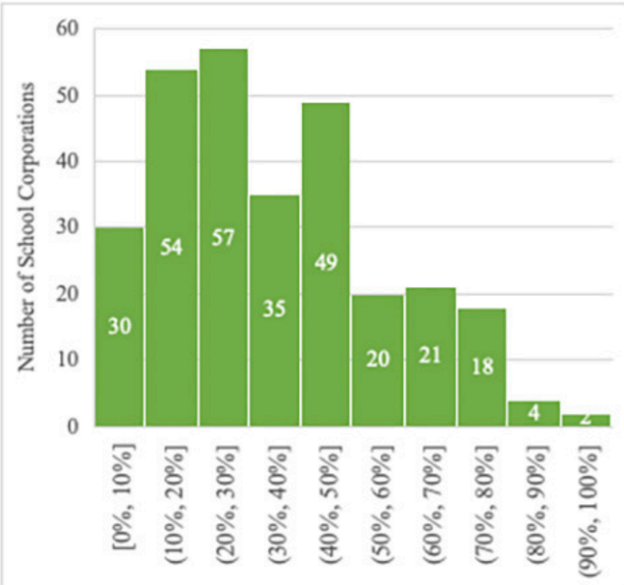
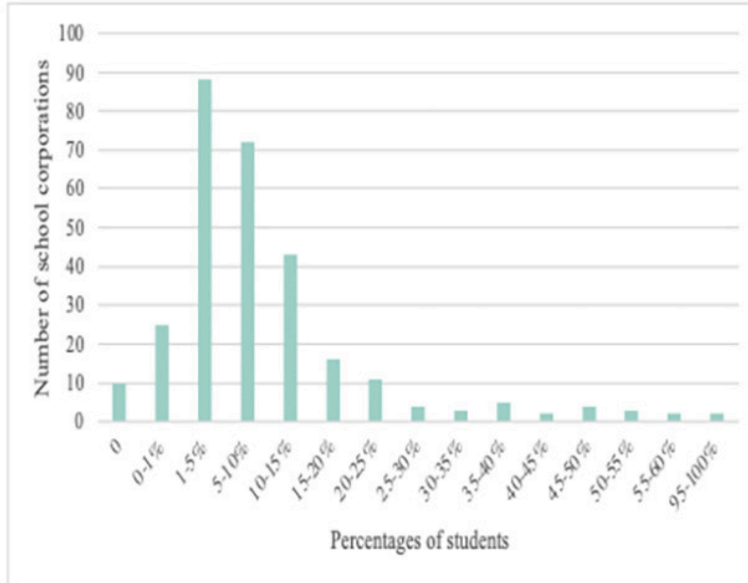


Figure 3. Students Who Don't Have Broadband at Home



Support for Virtual Learners

We investigated how schools supported students during virtual learning days by examining ways schools provided internet support for those who did not have access to broadband services at home and the staffing approaches used for virtual learners.

To contextualize these efforts, we first analyzed the percentages of students lacking broadband access at home (Figure 3). 203 school districts had 1-15% of students without broadband access at home. Only two school districts reported that over 95% of students had broadband access at home. These findings highlight the widespread need for schools to facilitate internet access during virtual learning days.

Table 3 summarizes how schools supported students without internet access at home. Schools employed three main strategies: providing internet access, distributing physical materials, or combining the two approaches. To make the internet available, school districts distributed hotspots, directed students to public internet locations (e.g., connecting to public internet at libraries), and extended school Wi-Fi availability after hours. For students in areas with limited internet services, schools supplemented these efforts by distributing physical materials.

We also examined how schools staffed virtual instruction (Table 4). Half of the school districts required classroom teachers to simultaneously teach both virtual and in-person students, synchronously or asynchronously, with no dedicated virtual teachers. Some schools compensated their classroom teachers for checking in with asynchronous students after school hours. A small number of schools hired instructional assistants or virtual coordinators to provide additional support for classroom teachers. Among the 156 school districts with dedicated virtual teachers, responsibilities varied. Some school districts assigned dedicated virtual teachers to deliver synchronous virtual lessons, leaving classroom teachers to manage asynchronous and in-person learners. Others relied on dedicated virtual teachers to conduct daily check-ins with asynchronous students.

Table 3. Ways to Support Students Who Do Not Have Home Internet Access

Category	No. of school districts
Provide internet accessibility support by distributing hotspots, providing a list of public Wi-Fi, extending school Wi-Fi use hours, etc.	70
In addition to internet support, distribute physical materials or make materials offline available	213
Only distribute physical materials	4

Table 4. Staffing Approaches for Virtual Learners

Staffing approaches	No. of school districts
Dedicated teacher only	42
Classroom teacher only	121
Both dedicated and classroom teachers are available	114
Some grades with vendors	8
Only vendor	2
No virtual	3

Barriers and Successes

We conducted thematic analyses of school districts' responses to three constructed response questions: the barriers they faced when implementing virtual instruction, their biggest successes, and how they were successful in engaging students in virtual learning days.

Barriers

School districts shared three major barriers to virtual instruction. 1. Availability of technology resources, including limited broadband internet access at home and a lack of devices for students. Many variables contributed to students' lack of broadband internet access at home, such as low-income families being unable to afford the service, inadequate infrastructure in rural areas, and family resistance to internet use for religious reasons. Additionally, in households with multiple children, insufficient bandwidth often hindered simultaneous access to synchronous online learning. 2. Teacher struggles. Teachers were not adequately prepared to teach across multiple modalities. Teachers experienced difficulties promoting students' engagement, tracking learning progress, and communicating with students and parents via technology. 3. Students' learning. Students frequently submitted incomplete or low-quality work, experienced declining grades, and struggled with time and task management. Younger students, in particular, faced additional difficulties due to lack of academic support from parents and childcare at home.

Successes

When answering the biggest successes over the past year with virtual/hybrid learning, the school districts shared the following successes: 1. Teachers' continuous growth in their competence and confidence in delivering virtual lessons. 2. Students' improvements in their technology literacy. 3. More eLearning resources implemented, such as learning management systems and new digital teaching tools.

Table 5. Strategies to Engage Students in Virtual/Hybrid Learning

1. Consistency between virtual and in-person instruction.
2. Create instructional videos.
3. The standardized layout of LMS.
4. Synchronous video check-ins.
5. Allowing flexibility
6. Designated staff to communicate with students and parents.
7. Daily small group and one-to-one tutoring sessions.
8. Diversify the ways of presenting information.

When sharing their strategies for engaging students during virtual and hybrid learning, many school districts candidly admitted that it was challenging to maintain high levels of engagement and expressed uncertainty about their success in this area. Nonetheless, summaries of schools' specific strategies to encourage student participation and involvement during virtual learning days are listed in Table 5.

Future Plans for Virtual Learning

We conducted a thematic analysis of school districts' responses to questions regarding the advances they made during the 2020-2021 school year that they plan to sustain in the future, as well as their top three professional development (PD) goals for the next three years. The advances that school districts identified as enduring include continuous PD for teachers and staff, the ongoing offering of virtual and hybrid learning models, the consistent technology integration in the in-person model, and the integration of K-5 computer science curriculum. When asked whether they would continue to offer a fully virtual option, 26% of school districts responded affirmatively, while 46% indicated they were considering it. In addition, 81% of school districts expressed plans to continue to utilize virtual learning days beyond the 2020-2021 school year, with 14% of them considering.

Table 6 lists the top three PD goals school districts identified in the next three years. Notably, school districts emphasized digital literacy. Many school districts listed specific goals related to digital literacy, such as virtual learning frameworks and digital assessments. These findings underscore the pivotal role that technology will continue to play in shaping instructional strategies and professional growth in the coming years.

Table 6. Professional Development Goals in the Next Three Years

1. Digital literacy, including the use of technology tools, cybersecurity awareness, and digital curriculum.
2. STEM and project- and problem-based learning.
3. Virtual learning framework SAMR, UDL
4. Social-emotional learning
5. Practices to improve student engagement in virtual learning
6. Computer science standards implementation
7. Data-driven instruction
8. DEI training
9. Authentic digital assessments
10. PBL

CS Instruction

We analyzed school districts' responses to four questions regarding their implementation of CS instruction: whether students received standard-based CS instruction, school districts' implementation strategies, where CS instruction took place, and who delivered the CS instruction. The findings, detailed in Figures 4,5,6 &7, revealed notable patterns.

We noted that Standards-based CS instruction was more commonly offered at higher grade levels than lower ones. For example, about 52% of schools provided CS instruction for kindergarteners, 61% for 4th graders, and above 64% for 8th graders. About 80% of K-8 schools provided CS instruction or were developing plans to implement it. This widespread commitment indicates a growing emphasis on equipping students with foundational CS skills.

Regarding implementation strategies, schools were more likely to mandate a set of lessons across the districts for lower grades, but higher grades often had more flexibility, leaving instructional decisions to individual school buildings. As for the location of CS instruction, the most common options across K-8 grades were required special rotations or standalone classes. However, for grades 6-8, elective CS courses were offered more frequently than required classes.

Finally, the personnel for CS instruction varied by grade level. School districts may have licensed teachers, media specialists, or TAs/paraprofessionals teaching the CS lessons. Licensed teachers were the primary instructors across K-8, but their prevalence increased with grade level. For example, while nearly 70% of kindergartens had licensed CS teachers, this figure rose to over 96% by 8th grade. Media specialists and teaching assistants (TAs) or paraprofessionals were also employed but to a lesser extent than licensed teachers.

Figure 4. Availability of Standard-Based CS Instruction

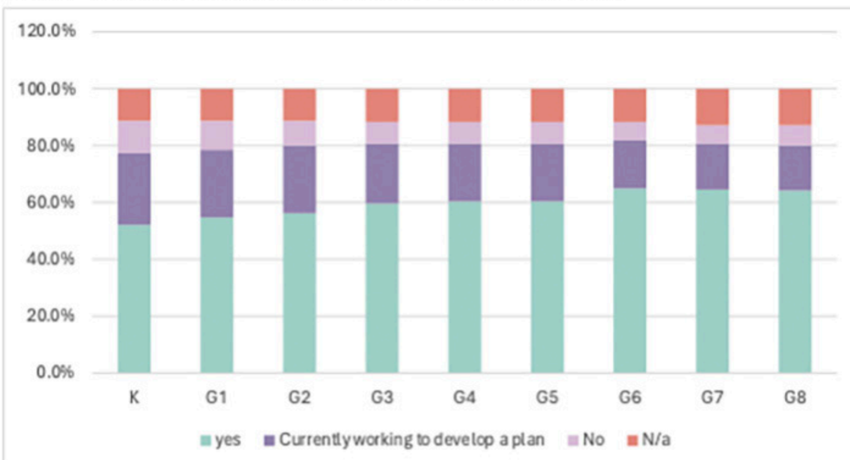


Figure 5. Schools' CS Implementation Strategies

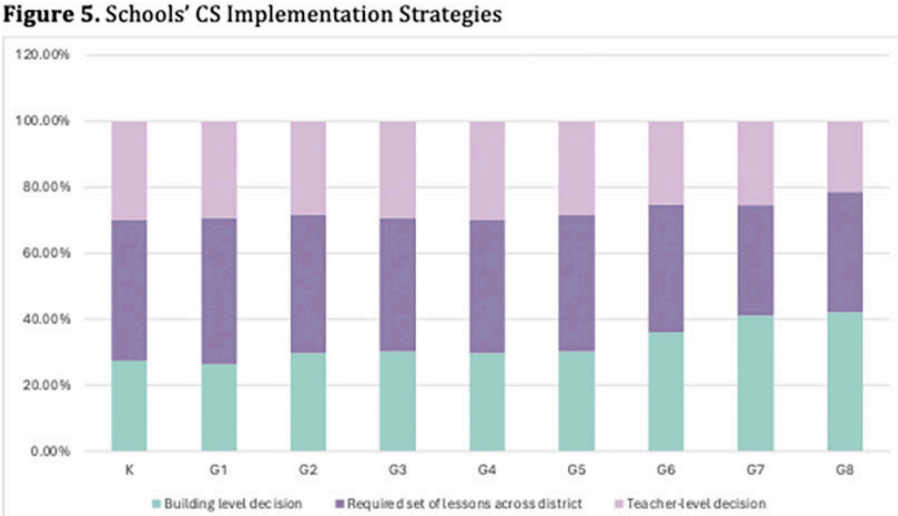


Figure 6. Where CS Instruction Takes Place

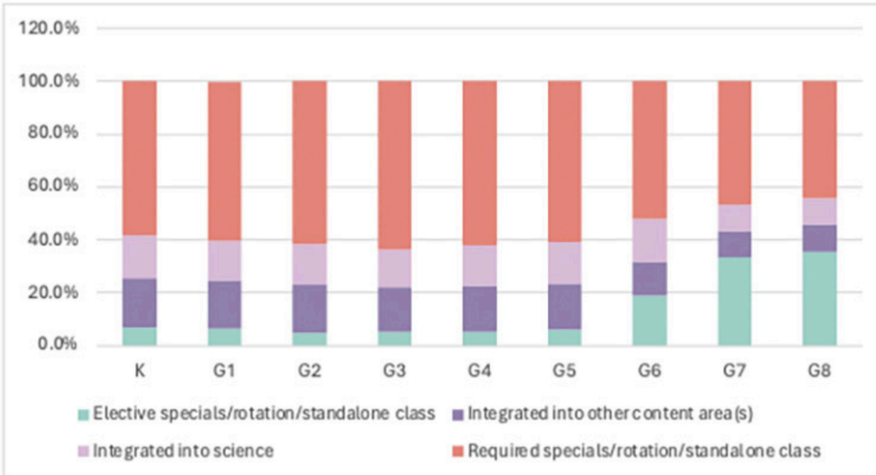
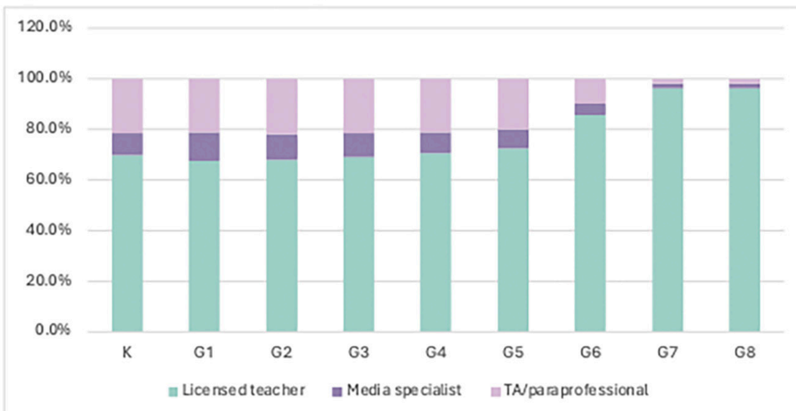


Figure 7. CS Instruction Staffing



Conclusion

This study analyzed two datasets published on the IDOE website, focusing on virtual/hybrid instruction and the implementation of CS education during the 2020-2021 school year. The findings suggest the popularity and complexity of virtual and CS instruction, leading to three key conclusions related to teacher education. First, almost all schools implemented some form of virtual and/or hybrid instruction, requiring classroom teachers to manage both in-person and virtual learners. This dual responsibility underscores the need for teacher preparation programs to include training in multi-modality instruction. Additionally, the study suggests that employing more dedicated virtual teachers could enhance student support, as teaching both in-person and virtual lessons simultaneously poses significant challenges for educators. Second, the effectiveness of virtual learning environments depends on several interconnected factors: the availability of technology resources, teachers' readiness to deliver virtual instruction, and students' preparedness for e-learning. Finally, while Indiana school districts were making strides in implementing CS instruction, significant disparities were observed between grade levels. Lower grades received fewer resources, including a smaller proportion of licensed CS teachers and fewer opportunities for standards-based CS instruction, compared to grades 6-8. This uneven distribution of resources points to an inequity in CS instruction across K-8 that should be addressed to ensure all students have access to foundational CS education.

The 2020-2021 school year was unique in that schools had to go through a rapid transition to virtual or hybrid instruction in response to the global pandemic. This study analyzed school districts' modes of instruction, their implementation of virtual/hybrid instruction, and CS education during this unprecedented time. We acknowledge that the datasets used in this study did not specify the roles of school personnel who answered the surveys, leaving questions about teachers' direct, first-hand experiences with simultaneous in-person and virtual instruction. Future research related to how teachers navigate virtual and in-person teaching in their everyday classrooms may better inform the design of PDs and teacher preparation curricula to better equip educators for both in-person and virtual instruction.

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HASTI Calendar of Events

HASTI Board of Directors

The HASTI website has a calendar of upcoming events to help you see upcoming meetings, conference and professional developments.

HASTI Events Page

To submit an event you would like to add to that list, email info and URL to thst@hasti.org

January 25, 2025 - Indianapolis Brain Bee - An annual event to motivate high school students to learn about the brain and inspire the pursuit of careers in neuroscience. IU School of Science, Indianapolis.

February 15 – 17, 2025 - HASTI Conference, Noblesville High School. For more information go to: HASTI.org

February 22, 2025 - East Central Indiana Regional Science Fair. Deadline for registration to participate is February 3, 2025. Ball State University.

February 27, 2025 - Northeast Indiana Envirothon Regional Competition. Peabody Public Library. Contact: Nadean Lamle@in.nacdnet.net or go to indianaenvirothon.org for more information.

March 5, 2025 - Central Indiana Envirothon Regional Competition. Franklin College Science Center. Contact BONeal@franklincollege.edu or go to indianaenvirothon.org for more information.

March 5, 2025 - Northwest Indiana Envirothon Regional Competition. Red Mill County Park. Contact: lschwab@laporteco.in.gov or go to indianaenvirothon.org for more information.

March 11, 2025 - Southwest Indiana Envirothon Regional Competition. Warrick County 4H Center. Contact: Susan.King@in.nacdnet.net or go to indianaenvirothon.org for more information.

March 12, 2025 - North Central Indiana Envirothon Regional Competition. Camp Buffalo. Contact: amanda.heltzel@in.nacdnet.net or go to indianaenvirothon.org for more information.

March 12, 2025 - South Central Indiana Envirothon Regional Competition. Lawrence County Fairgrounds. Contact: stephanie.baker@in.nacdnet.net or go to indianaenvirothon.org for more information.

March 13, 2025 - East Central Indiana Envirothon Regional Competition. BSU Environmental Education Center. Contact: elforstater@bsu.edu or go to indianaenvirothon.org for more information.

March 14, 2025 - West Central Indiana Envirothon Regional Competition. Ivy Tech Community College. Contact rcoombs@vigocounty.in.gov or go to indianaenvirothon.org for more information.

April - BSU Science Day (Date TBA). Over 20 activities for grade school children and their families. Ball State Student Affiliates of the American Chemical Society

April 5, 2025 - Indiana State Science Olympiad. Purdue University. https://www.pnw.edu/event/indiana-state-science-olympiad/

April 12th, 2025 - Bug Bowl. One of the largest insect festivals in the USA. Purdue University. https://ag.purdue.edu/department/entm/extension/bugbowl/events.html

April 12th, 2025 - Purdue Spring Fest. This free event is a great opportunity for people of all ages to learn about animals, art, astronomy and much more.

April 23, 2025 - Indiana Envirothon State Competition. Venue TBD.

April 25, 2025 - Eco-Science Challenge. K – Grade 12. Deadline for application is April 12, 2025. Indiana State Museum and Historic Sites.

Full listing of authors and contacts can be found at the end of this article.

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Open Access

Freebies! Free Resources for Teachers

HASTI Board of Directors

This feature of THST will provide information for teachers about free resources, PD activities, and materials.
Look for this feature in each issue!

The National Center for Science Education supports teachers with free classroom resources to "tackle the most common and pervasive climate change, evolution, and nature of science misconceptions that students bring to the classroom."

Customized Environmental field trips for high school students through the IU Integrated Program in the Environment. Contact Elspeth Hayden at haydene@indiana.edu

The On-Campus Writing Lab (OWL) at Purdue University offers on-line, easy to use, free MLA, APA, and Chicago style guides to help you with your writing projects. For those writing for The Hoosier Science Teacher, the APA Formatting and Style Guide (7th Edition) can be found here!

NSTA's Free Resources Page - A permanent feature of NSTA's website, free to anyone! Take advantage of these freebies from the biggest science teaching association in the world.

Free Planetarium Shows. **View the schedule of shows** at the Charles W. Brown Planetarium, Ball State University. Attend a public show, or schedule a FREE show for your class or organization.

On Point, November 27, 2024: The big promises – and hidden challenges – and AI. Arvind Narayanan, professor of computer science at Princeton University. Director of the Center for Information Technology Policy. Author of "AI Snake Oil: What Artificial Intelligence Can Do, What it Can't, and How to Tell the Difference."

Science All Year. Bacterial Viruses paper models; IU Museum of Archaeology and Anthropology Coloring Pages; a Locked Library Escape Room; a video on catching, banding, and releasing birds and collecting important data; and so much more.

Google AI Tools for Classrooms - Teacher recommended resources like **Quick, Draw, Say What You See**, and **Teachable Machine**.

Three Facebook Groups:
Teacher Freebies and Deals.
Free Teacher Stuff, Discounts and Tips.
Teacher Deals, Codes, Coupons and Freebies by Buying on a Budget.

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The Hoosier Science Teacher

Open Call for Papers

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The editorial board of the *THST* invites authors to submit manuscripts in categories that include: "Editorials, Opinions, Announcements," "Lessons," "Stories, Poems, Nonfiction," "Articles, Research," and "Curriculum & Learning Environments." Authors need to consider the target audience when planning and writing the manuscripts they submit.

THST publishes at least one issue of the journal each year, and we offer an open call for manuscripts submitted by authors. There are no submission deadlines for our regular issues, and authors may submit manuscripts at any time. Special "themed" editions may be produced with guest editors. *THST* will post Calls for Papers on the journal's website to announce those issues.

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