



IoT In Education: How Gettysburg College Built Student-friendly Alexa Skills

Content-as-a-Service is fueling the IoT revolution in Education and Beyond

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IoT In Education: How Gettysburg College Built Student-friendly Alexa Skills

Content-as-a-Service is fueling the IoT revolution in Education and Beyond

Internet of Things (IoT) devices are disrupting age-old industries, fueling startup innovation and changing the way we live our daily lives. Gartner forecasts that by 2020, the number of IoT devices will surpass 20 billion units¹ – more than double the earth’s human population.

One long-standing name in the higher education sector, Pennsylvania-based Gettysburg College, has not only recognized this reality, but has embraced it by simplifying student life through the IoT device of the moment, the Amazon Echo.

The Emergence of The IoT Era

“Visual content is being formally joined by audio content and audio commands – and IoT devices have everything to do with it.”

Traditionally speaking, digital content has been predominantly visual. At the dawn of the world wide web, brands build web pages that served customers with written content supplemented by imagery via web browsers. That’s because most web surfers were browsing the web via desktop computers or laptops.

When the modern smartphone emerged, brands had to think about making their content responsive, as consumers were using various screen sizes to access content online. As a result, each web page needed to look presentable no matter which device was being used to access it. But still, the concept of online content being predominantly visual was untouched.

Today on the other hand, the average consumer isn’t just using different sized screens to access visual content, they’re talking to voice assistants like Alexa, Siri and Cortana, bypassing the need for a web browser entirely. In fact, 25 percent of 16-24s use voice search on mobile², while the number of households in the US with smart speakers grew 49 percent between June and November of 2017³. In simpler terms, visual content is now being formally joined by audio content and audio commands – and IoT devices have everything to do with it.

“When we had computers connected to the internet, our content was presented in one fashion and that was made visually through a web browser. And with the development of the smartphone, we had to shift our content into a different format but it was still visual. With the IoT and the introduction of Siri and Alexa, we had to think of Content-as-a-Service,” explained Rod Tosten, VP of Information Technology at Gettysburg College.

As a result of this shift in content consumption norms, Gettysburg College sought out dotCMS, an open source platform with Content-as-a-Service — also known as headless content management — baked in.

Interestingly, the technology present in smart voice assistants is now sprouting up in other devices, from refrigerators to cars. Samsung’s Family Hub Refrigerator⁴ for example boasts a large touchscreen that lets users track food expiry dates, see inside their refrigerator, organize family schedules, draw and take notes.

“We’ve seen an explosion of [IoT devices]. We have transitioned away from only having our computers being connected to the internet to having smart TVs, refrigerators and devices like Amazon Echo.”

— Rod Tosten

Beyond voice assistants and smart refrigerators, further examples of IoT devices include:

- Smartwatches
- Fitness Trackers
- Smart Thermostats
- VR Headsets
- Smart lighting systems

And yet the technology underpinning these IoT devices is in its infancy.

With such revolutionary IoT devices going mainstream, brands need to think about content delivery in an unprecedented way, particularly when it comes to smart voice assistants like the Amazon Echo.

¹ [Gartner \(2017\), “Gartner Says 8.4 Billion Connected “Things” Will Be in Use in 2017”](#)

² [Global Web Index \(2016\), “Study: 25% of 16-24s use voice search on mobile”](#)

³ [Comscore \(2017\), “The Future of Voice From Smartphones to Smart Speakers to Smart Homes”](#)



IoT In Higher Education

The education sector isn't averse to technological advancements. The introduction of interactive whiteboards back in the 1990s, for example, revolutionized the way teachers and students interacted in the classroom.

In 2014, Lee W. McKnight, a professor of entrepreneurship and innovation at Syracuse in New York, revealed that "students and faculty are actively experimenting with a wide variety of new IoT and M2M applications and open specifications."⁵

"Global student RFID tracking market will grow steadily over the next four years and post a CAGR of almost 9 percent by 2021"

Syracuse University has since been working with microcontrollers and sensors to measure everything from air quality to temperature.

"When you connect the [microcontrollers] to the Internet, it can upload data to a database so that others can see it and compare to their own data. These citizen sensor networks provide an alternative to government-reported data sources," McKnight said.

Elsewhere, universities across the US are leveraging RFID (radio-frequency identification) technology to track school resources such as lab equipment and projectors, to register and report on individual student attendance, facilitate communication between teachers and parents and to bolster school security systems with electronic ID cards. Tellingly, market research analysts at Technavio predict that the global student RFID tracking market will grow steadily over the next four years and post a CAGR of almost 9 percent by 2021⁶.

But in the case of Gettysburg College, Rod Tosten wanted to take IoT in education a step further by using a device that their students already knew, loved and wanted to see more of.

⁴ [Samsung \(2017\), "It's more than a fridge. It's the Family Hub"](#)

⁵ [Forbes \(2014\), "How Universities Are Adapting To The Internet Of Things Revolution"](#)

⁶ [Technavio \(2017\), "Global Student RFID Tracking Market 2017-2021"](#)

Gettysburg College: A History of Forward Thinking

Established in 1832, Gettysburg College — then known as Pennsylvania College — was founded by anti-slavery theologian Samuel Simon Schmucker during a period when racial tension in North America was high. Five years later, the college moved into Pennsylvania Hall, which was built on the land provided by abolitionist Thaddeus Steven, whose career in Congress helped to establish the 14th Amendment, which granted full civil rights to citizens of all states.

On July 1, 1863, two armies marched through the campus to mark the first day of the Battle of Gettysburg. During that battle, Pennsylvania Hall became a hospital for both sides of the civil war.

Later that same year, on November 19, 1863, Abraham Lincoln had been invited by 1851 Gettysburg graduate, David Willis, to deliver his iconic Gettysburg Address. Thousands of townspeople, students and faculty members marched towards the National Cemetery to hear what his words.

“Today, Gettysburg College is recognized as a Liberal Arts college that helps prepare students from both the US and around the world to pursue personal and professional fulfillment.”



» Gettysburg College

Fast forward to the present day, Gettysburg College is recognized as a Liberal Arts college that helps prepare students from both the US and around the world to pursue personal and professional fulfillment by encouraging critical thinking and developing a broad vision.

So, when those ambitious students began asking questions about how the college could lean on Amazon's latest technology to simplify student life, Gettysburg college got to work.

"We had emails asking us can we get dining menu through Alexa. And that's what gave us the idea to work on these skills," said Rod Tosten.

"When we started exploring Amazon Alexa, students started to request different skills," he continued, explaining how Gettysburg College eventually launched two Alexa Skills, with more in development.

A Look At The Gettysburg College Alexa Skill Set



» Rod Tosten, VP of Information Technology at Gettysburg College

Gettysburg College has two Alexa Skills available at the time of writing; The Gettysburg Dining Menu Skill and The Gettysburg Calendar Skill. However, their Phone Directory Skill and News Skill are on the way. The former will give students quick access to important phone numbers, while the latter allows them to search for news stories.

“Once [development is] complete, it’s like the app store and Amazon will put it in their skill store,” Rod explained.

The Gettysburg College Dining Menu Skill

“We developed a skill for our dining menus. It is the most popular page on our website. And it is something that students want to know about all the time.” said Tosten.

“Alexa, ask Gettysburg College dining to get menu for Dive on Wednesday”

Gettysburg's Dining Menus skill allows the user to find out what is on the menu at Gettysburg dining hall and surrounding venues. There are two different ways to retrieve the menu as explained by Tosten:

"You can [either] ask it a question and it will return what you're looking for on the menu or you can go back and forth and ask it a series of questions so it can help you through getting to your answer — that's where the conversation and flow has to be in the consideration."

The Gettysburg College Calendar Skill

Also available to Gettysburg College student and faculty, is the Gettysburg College calendar skill.

Users can interact with Alexa to find out which events are scheduled, on which days. Alexa then lists the events on offer. Thereafter, users can ask Alexa to explain what specific events are about to see if they want to attend. Once again, the element of conversation comes into play, a concept which we will come to discuss in more detail.

**"Alexa, ask
Gettysburg College
Calendar what's
going on Thursday."**



Why Alexa?

While Gettysburg College was indeed receiving requests from students regarding Amazon Alexa, there were underlying reasons for the swiftness of their approach to building Alexa Skills.

“These devices are the future,” Rod claimed.

He explained that Amazon Alexa represents a shift in the way that we have to think about content. Whereas before content was delivered visually to web browsers, now, developers and marketers alike need to embrace Content-as-a-Service.

“It is a shift from a one-way presentation to a conversation, because with Alexa, people can start to talk back and forth with the device to pull in content. It’s not only faster, it also enables the user to have a relationship with the content rather than just consuming it in one [rigid] way,” Tosten said.



“Amazon CEO Jeff Bezos
revealed that the
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“tens of millions” of
Alexa-enabled devices”

Moreover, the sheer popularity of Alexa played a role. In late 2017, Amazon CEO Jeff Bezos revealed that the company has sold “tens of millions”⁷ of Alexa-enabled devices. Growth was also observed with regards to the number of Alexa Skills on offer, with the total number of Alexa Skills reaching the 25,000 mark⁸. And yet just a few months before, back in March 2017 a mere 10,000 skills were developed. Meanwhile, Google claims to have sold one Google Home device every second since launch day⁹, amounting to well over 6 million units at the time of writing.

How To Create And Deliver Alexa Skill Content

Developing an Alexa Skill is unlike developing a web page or visual app. The way content is stored and delivered matters, the way that content is parsed plays a role, and how the entire experience should flow is unique to voice assistant consumer experiences.

While Amazon lays out its own guidelines for Alexa Skill development, Rod Tosten of Gettysburg College asserted that there are four major considerations that developers need to keep in mind when developing an Alexa Skill.

1. Content Considerations

First things first, you need to get your content in order.

“What information are you trying to share with the user, and where is it? How much processing does it take to form the content into speech? How should the content be formed to work easily with a web browser, speech, and mobile display? This is related to the CMS or information/web service. You need to think about how your content is [managed, stored and formatted] in your CMS,” Tosten explained.

In other words, your digital experience platform will need to offer you Content-as-a-Service, also known as the ability to store, manage and deliver content headlessly. This functionality is vital for developing an Alexa Skill, particularly if you want to keep your technology stack lightweight, cost-effective and agile in the ongoing struggle to develop for multiple devices and channels.

“The Gettysburg College News Skill involved dividing the results into different levels, allowing the user to digest the information much easier.”

Next, you’ll need to think about the utterances. Your Alexa Skill may have multiple functions, or one function. As far as Amazon’s Skills Kit¹⁰ is concerned, each function or feature is called an ‘Intent’. To activate an Intent, the user must say an ‘Invocation’, ‘Utterance’ and fill in ‘Slots’, which together make up the question or command that Alexa understands. Due to the flexibility of the English language, there could be several variations in the ways that these questions or commands might be phrased. Thus, you will need to program many valid Utterances that your Alexa Skill will accept.

⁷ [TechCrunch \(2017\), “Amazon sold ‘millions’ of Alexa devices over the holiday shopping weekend”](#)

⁸ [TechCrunch \(2017\), “Alexa skills top 25,000 in the U.S. as new launches slow”](#)

⁹ [Google \(2018\), “How Google Home and the Google Assistant helped you get more done in 2017”](#)

¹⁰ [Amazon \(2018\), Amazon Skill Kit](#)

Here's a breakdown of the definitions of Intent, Utterance and Slots.

Intent

An intent is what a user is trying to accomplish. It doesn't relate to the specific words that a user says, but the high-level goal they are aiming for.

For example, with the Uber Alexa Skill, the Intent of the user is to call an Uber car.

Utterance

Utterances are the specific phrases that people will use when making a request to Alexa, and because utterances are bound by what the user says, they can vary greatly. For example:

"How's the weather?"
 "Is it cold?"
 "Do I need an umbrella?"

When developing a skill, utterances have to be coded to tell Alexa what to expect. This can mean typing out dozens of very slight variations of questions and statements in order to encompass everything a user might say in relation to their Intent.

Slot

A slot is the variable inside the Utterance that the user can switch out in order to specify their Intent. For example:

"How's the weather tomorrow?"
 "Will it be cold next week?"
 "Do I need an umbrella tonight?"

Amazon provides a number of built in slot types, such as dates, numbers, durations and times.

"You have to ask yourself about the format of the [utterances] that users will use to speak to Alexa. What are the major components of those [utterances] needed to retrieve the right content for the user? Once you have the syntax for the questions, then you create [acceptable] utterances," said Tosten.

For example, in the Gettysburg College Dining Skill, the utterance you use has two interchangeable words, "Alexa, ask Gettysburg College Dining what's on the menu at 'Dive' on 'Monday'?" — but the syntax challenges don't end there.

"We had to teach Alexa that the word 'On' may or may not be part of the utterance. This is similar to what a dev will do when they deliver content visually, determining the flow of content from top to bottom, left to right. This is just flow of conversation," explained Tosten.

When your utterances are configured, it's time to think about the output. What information will your Alexa skill serve back to the user, depending on the utterance?

"When designing a skill, you need to consider the amount of the content [each output] will have," says Tosten, "with our News Skill for example, users can either hear the title of the news story, or the brief of the news story or they can hear the whole news story read aloud. So we are not just taking into the consideration of the list of result, but picking out one result and then digging in deeper into that result."

Tosten revealed that the design of the Gettysburg College News Skill involved dividing the results into different levels, allowing the user to digest the information much easier. And if the user wants to find out more about a particular story, then they are able to do so by asking for it. Each of these conversational stages — and potential stages — need to be mapped out and accounted for with content.

2. Conversation and Flow



Every interaction a user has with your Alexa Skill is a conversation, and all conversations need to flow effortlessly for the sake of a positive customer experience.

Tosten called attention to the importance of developers being, "conscious of delivering each response in a way that allows for users to easily hear and engage in order to promote conversation."

"Developers need to think about formatting content so users can consume it through sound instead of sight."

Back on the subject of content management briefly, developers need to think about formatting content so users can consume it through sound instead of sight — a task which poses unique challenges. However, Tosten claimed that content for an Alexa Skill can, "still be same content [that you might publish online], but it needs to be

reformatted in a different way. Developers need to take visual content and parse it so it can be consumed through sound."

Tosten went on to describe how his team has to have an important consideration in mind when developing the Gettysburg Phone Directory Skill.

"[Our team] had to think hard about how to present the information. This is especially the case if you are looking for a person who's full name or department you can't recall. If you have a list of 15 items for example that you want the user to hear as a result, you can't have the device speak all 15 results at once because the user is going to forget," explained Tosten.

Their eventual solution was to break down the list of results into groups of three, allowing the user the time to select one of the three options, or move forward with the list.

3. Speech and Card Presentation

When it comes to actually turning your text into speech, Alexa does most of the heavy lifting. However, there's still plenty to consider.

Tosten advised developers to, "think about any potential language issues. For example, should 123 be pronounced as "one two three" or "one hundred twenty-three"?"

"Amazon Echo comes paired with iOS and Android apps which can display 'Cards', which could be text or image-based visuals."

Other considerations may include the general length of each Alexa response or whether the development team wants their Alexa Skill to be casual and conversational, or professional and succinct. While there is no right or wrong option, the skill should reflect the wants and needs of the organization's target market in order to deliver the best possible customer experience.

Furthermore, it's worth remembering that the Amazon Echo comes paired with iOS and Android apps which can display 'Cards', which could be text or image-based visuals. Developers can leverage Cards to get their messages across more effectively, although it's fair to say overusing cards will detract from the expected audio-only experience that the consumer will expect.

4. Implementation

Implementation is the fourth and final step, but developers will need to take it wisely — particularly if they want to develop further Skills in the future.

"Developers should ensure that they format a skill template so that it can be used over and over again, with a small amount of formatting each time," Tosten advised.

"The Amazon Skill Kit¹¹ provides developers with further guides, tips and strategies for Alexa Skill building."

Moreover, developers will need to get familiar with how to configure and translate utterances into a 'Speechlet'¹² that will handle the requests by the user. A Speechlet is a speech-enabled web service that runs in the cloud, receiving and responding to speech initiated requests.

Once the above considerations have been deliberated over, all that's left to do according to Tosten is, "implement [your Alexa Skill] with Java, Python or Javascript."

The Amazon Skill Kit¹¹ provides developers with further guides, tips and strategies for Alexa Skill building, ranging from a selection of self-service APIs to ideas on how to monetize an Alexa Skill through in-skill purchasing and Amazon Pay.

¹¹ [Amazon \(2018\), Amazon Skill Kit](#)

¹² [Amazon \(2015\), Interface Speechlet](#)

The Future Is Content-as-a-Service

IoT, Alexa, Siri and more have shifted how customers consume content. A one-way presentation of content is no longer enough.

Brands are turning to Content-as-a-Service (CaaS) platforms — also known as headless content management systems — as a way to future-proof their content. With a CaaS model, content is stored separately from the presentation layer, meaning it can be pushed to any connected device or channel in the Internet of Things. That means Alexa, Google Home, a mall kiosk screen and even a drone are all within reach of your content management system. Moving to a CaaS model means brands need to shift their thinking when it comes to creating, storing, and presenting content.

“Amazon’s Alexa represents a major shift in the way we think of content. It’s really driving home the concept of Content-as-a-service, and moving away from the concept of content living on a web page exclusively.” — Rod Tosten, Gettysburg College



The shift is not only in how brands present their content, but it is also a shift in how users are interacting with your content. The Internet of Things means moving away from content simply living on a webpage to an interactive conversation with users, as Gettysburg College’s Rod Tosten affirms.

“Amazon’s Alexa represents a major shift in the way we think of content. It’s really driving home the concept of Content-as-a-service, and moving away from the concept of content

living on a web page exclusively. We need to think of Content-as-a-Service [because content is now being] consumed by many different devices, which is what the Amazon Echo is teaching us,” he said.

Whereas content used to be predominantly visual, framed inside a web page, Tosten asserted that content is now, “shifting into audio, moving us down a path such as toys, cars and appliances that will consume content allowing us all to converse with them.”

With Content-as-a-Service making brands rethink how they must generate content to be consumed by many different devices and in many different formats, new considerations need to be made, particularly when it comes to cost.

“The key is headless content management — content that’s housed in one, secure location, but can be delivered anywhere through APIs.”

“It is expensive to generate content, and we don’t want to generate content for one device and then regenerate content again for another device and then regenerate the content again for a third device, and so on. It takes a little bit more thought to generate the content [in a Content-as-a-Service model] but formatting and presenting [the content] is not in a visual way anymore. But it is a conversation.”

Artificial intelligence will be the next step for IoT devices, helping brands deliver faster, more personalized customer experiences. In turn, this will lead to finely orchestrated customer experiences where brands can use voice assistants or household appliances to collect data, deliver messaging and makes sales to customers inside their homes, offices and vehicles. The key to all of this, is headless content management — content that’s housed in one, secure location, but can be delivered anywhere through APIs.

Disrupt, Or Be Disrupted

Consumer attention has been fragmented across dozens of devices and channels. The era of desktop-centric consumerism is dead, and IoT devices are here to make sure of it.

Just as household brands were disrupted at the start of the millennium by ambitious, technologically-savvy startups (Blockbusters demise at the hands of Netflix is one example), the IoT era will produce new names and industry leaders. The question is, will existing brands and institutions disrupt themselves, before they get disrupted by somebody else?

Gettysburg College wanted to be of those organizations who innovated before anybody else could, and their small but growing set of Alexa Skills is a testament to that.

**“Will existing brands and institutions disrupt themselves,
before they get disrupted by somebody else?”**



“The future is smarter devices. If we look at voice assistants on smartphones, the concept was [the user] asks one question, and the search would be executed for them. But today, we’re having actual conversations [with voice assistants]. AI will be the next step which will be integrated into these devices. It will help us organize the data in a better format and process it more accurately,” Tosten said.

IoT devices are also ripe for personalization according to Tosten, who explained that, “remembering who the user is and how they engaged with the device before [in order to personalize and speed up IoT experiences] will become a big part of where these devices will go next.”

About dotCMS

dotCMS is an open source customer experience orchestration hub with headless content management capabilities. Global brands use dotCMS to build, manage and deliver engaging content to websites, apps and IoT devices and orchestrate a continuous and connected experience.

dotCMS delivers a customer experience that can be orchestrated, connected seamlessly across all channels and is continuously available and secure.

Over 10,000 sites in 70 countries rely on dotCMS to power their digital properties. From Fortune 500 brands and mid-sized businesses to dynamic start-ups and digital agencies, dotCMS delivers proven business results across a wide range of industries and organizations.

Schedule a dotCMS demo at dotcms.com