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NMC Horizon Project Strategic Briefs provide analyses and summaries of timely educational technology topics, trends, challenges, and developments. The information presented is intended to provide companies and their constituents with the most timely, freshest analyses and perspectives available. For more information, visit horizon.nmc.org.

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Citation

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Executive Summary

Course Apps: An NMC Horizon Project Strategic Brief was commissioned by Adobe Systems to explore the emergence of new forms of instructional resources, known informally as “course apps” — special mobile applications with functionalities that promise to redefine the category. The report will look at the evolution of the key features of course apps — mobility, interactivity, engaging design, and integrated analytics — and showcase how course apps are sparking new thinking in higher education about the next iteration of digital learning resources.

In September 2015, OECD released the landmark report, Students, Computers, and Learning, which depicted the current state of educational technology as ineffective in improving student learning outcomes.1 While many pundits were quick to release blog posts and news stories lamenting the end of edtech,2 this interpretation may not paint an accurate picture of the challenge. OECD’s report chronicled the digital divide and the inequity of Internet access; students may be using computers in class, but they are not all connected to networks. Furthermore, technology is too often used simply as a substitute for equally viable methods, and not to expand learning activities into new territories. E-books, for example, are frequently just straightforward conversions of the print versions to an electronic format with no new dimensions added to foster a deeper, more meaningful experience for the reader.

The critical task ahead for innovators in the education space is to create more robust technological tools that not only push the boundaries of what is possible, but also redefine them. Course apps generate the kind of excitement that may make that possible in the case of instructional resources like the textbook.

To promote the kind of innovative thinking that may be helpful, Course Apps tracks the convergence of four trends that are enabling a completely fresh perspective on what instructional materials look like, and more importantly, what they are capable of doing. These trends are 1) the move from print-based textbooks to digital, 2) the increasing mobility of learning, 3) innovations in print and web-based design, and 4) the convergence of web and learning analytics. Each of these trends is spurring new visions of what digital course materials could look like, and how they can foster more engaged learning; together, they are fueling a grassroots wave of innovation.

In many ways, the rapid growth of digital textbooks in the past decade has outpaced the publishing industry’s ability to innovate in this space. Companies have created tools for digitizing vast amounts of print materials efficiently, but not enough attention has been dedicated to enhancing their social, interactive, and immersive capabilities. As a result, they are not yet ideal learning materials for students that crave richer engagement and active learning experiences. At the same time, mobile learning has been constantly evolving, culminating to the present landscape of always-connected devices with a host of built-in features, such as sensors and GPS, and hundreds of thousands of apps that can be used to spur anytime, anywhere productivity.

The design of mobile apps is being continuously influenced by the desire to draw people in and keep them curious. Effective design creates an authentic relationship between the person and the content, through intuitive features. In the shift to digital, designers are working to capture and improve upon the sleek look and feel of glossy print magazines while keeping the user front and center. Further, sophisticated analytics are enabling a backchannel flow of information and communications that enable companies and education institutions to better understand how all their content and features are being used.

Later in this report, two examples of course apps in current use are highlighted, and the discussion draws on interviews with early developers of course apps to give insight into the thinking of the higher education leaders who envisioned them. Finally, a conclusion is presented on how intelligent course apps can be creatively applied by institutions and instructors all over the world.
Reimagining the Textbook

Four major trends are converging to give rise to new possibilities for instructional resources, and especially the textbook. Digital textbooks, mobile learning, design, and analytics have all been evolving for some time. They will continue to do so as thought leaders fathom fresh uses for them with the goal of enhancing digital learning experiences for students and providing educators with innovative ways to approach content creation and delivery. The trajectory of each of these metatrends has influenced new developments within the others. The sleek designs of modern magazines, for example, have impacted the look and functionality of e-books and mobile apps. Tracing the evolution of these trends reveals the interesting ways in which they intersect, along with the inherent opportunities for fueling the development of intelligent course apps. Two of the trends in particular, digital textbooks and design, have not yet reached their full potential in higher education, and there is space for institutions and education-focused companies to take them to the next level in service of teaching and learning.

Digital Textbooks

The move from print to digital textbooks has not seen the learning and engagement gains that many hoped would come from digitization.\(^1\) In 2007, in one oft-cited example, the South Korean government noted the rapid global growth of tablets and smartphones and developed a strategic roadmap to completely digitize class materials by 2015 — a plan that included trading in all print textbooks for digital.

However, Korean education leaders began to surface red flags, citing mobile devices as potential distractions. There was an overarching concern about students learning through screens rather than experiencing the world around them, an acknowledgment that e-textbooks did not facilitate immersive learning. As a result, South Korea scaled back the usage of digital textbooks, choosing to implement them alongside their print counterparts in a pilot at only 50 schools.\(^4\)

Fast-forward to the past couple of years and the same apprehensions are still commonly held. In 2010, five California state universities launched one of the first well-publicized US e-textbook pilots, and generated considerable student feedback. Common themes of dissatisfaction materialized in a survey of 662 participating students. Issues cited included low readability, technical difficulties, and an overall lack of note-taking and other productivity features.\(^5\) Similarly, a recent EDUCAUSE Center for Analysis Research study on e-textbooks revealed that while the 5,000 students surveyed appreciated their greater portability, they expressed frustration about the lack of offline access and difficulty using the e-textbook on a variety of mobile devices.\(^6\)

The SAMR model of technology integration provides an effective framework for depicting the state of digital textbooks and where there is room for improvement. The SAMR acronym is an easy meme for four distinct levels of technological implementation: “S” is for Substitution, where technology acts as a direct tool substitute, with no functional change; “A” is for Augmentation, where technology is still a tool substitute, but there is some functional change; “M” is for Modification, where technology allows for significant learning task redesign; and “R” is for Redefinition, where the capabilities of the technology being employed allow for the creation of new tasks that were previously inconceivable.\(^7\)

Most digital textbook efforts to date have been at the substitution level. The typical digital textbook is simply a digital version of what is also available in print; no new value is added to the learning experience for students other than replacing the book itself with a tablet or e-reader. What has become increasingly clear is that digitization is just the first step, and it only scratches the surface of what is possible. Ushering digital textbooks into the more advanced stages of SAMR will require moving beyond merely converting printed books to electronic formats, and incorporating entirely new features that not only promote deeper learning engagement, but that can document it in real time.
Adding to the pressure for new ideas is the commonly agreed upon view that the current textbook market has declined to the point of unsustainability. The cost of print textbooks has been rising in response to pressure from used and rental book markets, as well as the shift to digital. During the last ten years, prices have increased by 82% — triple the rate of inflation. As a result, 64% of college students have opted not to purchase required reading for their courses. Companies such as Amazon and Chegg have developed e-textbook rental programs as a potential solution, but pundits have been quick to comment that these digital versions are flat, and fall short of offering students any added features or capabilities.

At the same time, the consumer market for digital books has grown significantly. Amazon has been particularly successful in the digital reading space, announcing as far back as 2011 that their e-book sales surpassed their print sales; this trend has largely continued over the past four years. There is a significant difference, however, in the expectations readers have for the digital experience of novels versus their expectations for textbooks. Whereas many works of fiction translate well to the basic electronic book format, textbooks have historically included elements such as charts, review questions, and imagery that do not, and the challenge of digitizing them is thus far more complex.

As pressure mounts to move away from paper-based textbooks, there are reasons why this shift has not yet been entirely successful. Digital textbooks, as they are currently designed, are simply not compelling. The technology does not often open doors to new ways of interactive learning, and the category in general is ripe for innovation. Because of this, and all the pressure to go digital, there is a tremendous latent demand for well-designed digital textbooks that incorporate video and other rich media, interactive features such as responsive charts that can be used to examine the impact of key variables, frequent knowledge checks, rich discussion and feedback tools, and integrated analytics.

**Mobile Learning**

The NMC began tracking mobile learning in 2006, which at the time centered around the use of basic mobile phones; since that time the market has evolved at an unprecedented pace, and references to mobile learning have made appearances in the NMC Horizon Report every year since. While the growing pervasiveness of cell phones on college campuses was initially seen as a distraction to some, others began to explore the educational potential of extending learning by using messaging tools, polling systems, and other mobile features for increasing peer interaction within the classroom.

It is hard to understake the importance that mobile networks had on the establishment of ubiquitous high-speed wireless access, which has become a key affordance of the mobile learning ecosystem. Back then, there were many contenders in the mobile space — personal digital assistants and netbooks were all attempting to leverage this new always-connected computing environment. A never-ending stream of new capabilities has expanded the potential year after year for the past decade.

In 2006, the category of mobile devices also included mp3 players; these were used to deliver multimedia educational content to students. The following year, the first glimpses of the convergence of all these tools into mobile phones began to appear with the release of the iPhone. They served as address books, file storage devices, cameras, video recorders, way finders, and handheld portals to the Internet. This was also the time when websites and blogs began to automatically detect if the user’s browser was housed on a phone and format content accordingly. 2007 was a watershed moment in mobile computing — Android and iOS took hold, and the market for apps began to take off. With new touch displays and increased access to web content, smartphones quickly became essential tools, bringing the whole of the Internet and its rich social tapestry to peoples’ fingertips.
Mobile capabilities began to evolve rapidly following the introduction of the smartphone, which further blurred the boundary between phone and computer. From education to networking to personal productivity on the go, mobiles seemed to harbor infinite possibilities.

Mobiles continued to evolve rapidly in the next few years, culminating in the 2010 launch of the iPad. Today, these all-purpose mobiles have all but replaced the need for dedicated e-readers. With increased screen real estate and battery life compared to phones, and access to the same incredible array of applications, these new mobile devices quickly became a viable alternative to heavier, more expensive laptop computers. Quickly the focus for educators shifted from the devices themselves to the myriad mobile applications they housed. Many higher education institutions began developing their own apps to better connect students to campus events, news, and learning management systems.

This was also the time when game-based learning, especially social games such as “Words with Friends” and “Farmville,” began to gain traction as mobile devices enabled access from literally almost anywhere, and computing became a recreational activity.

The ubiquity of mobile usage has progressed at such a rapid rate that even the most liberal predictions could not anticipate the growth. We Are Social reported that there are 3.65 billion unique mobile users, representing 51% of the world’s population of 7.2 billion people\textsuperscript{14} — and mobile sales continue to increase year over year. In early 2015, Gartner reported that smartphone sales totaled 1.2 billion units globally — up nearly 30% from 2013.\textsuperscript{15}

Inexpensive smartphones are bringing the Internet to emerging markets for the first time, while in mature markets they are shifting the paradigm to a more mobile-centric approach to delivering media and services.\textsuperscript{16} Mobiles and mobile apps have redefined what we mean by Internet access, and what we use it for. Attention has drifted away from the web, with 86% of users’ time being spent in apps.\textsuperscript{17} Apps work in fundamentally different ways than websites, and their compelling uses, particularly in education, continue to expand.

Design

The digital age has caused a massive shift in the way magazines and newspapers conceive of their content and mode of delivery. While the move from print to digital was considered a necessary adaptation, spurred by a declining trend in the number of subscribers and diminishing ad revenue,\textsuperscript{18} continuous innovation in technology is having an unprecedented impact on publishing and the kinds of designs that drive readership and sales.

For decades, print publications have relied on large, eye-catching images, bold typeface, and glossy front covers to draw readers in.\textsuperscript{19} As formerly print-based publications moved to the web, designers were tasked with adapting those principles to digital platforms, but catchy graphics and page designs were not enough. The added element of interactivity that the web affords compels designers to consider the ongoing functionality of the layout; this was a fundamental change in the way the audience interacted with the design. No longer passive, web readers interacted with online content, and if they did not like what they found, another website was a click away. The effectiveness of web design is an essential determinant of how long users will spend on a given website.\textsuperscript{20} While the field of web design is constantly evolving, modern web design has come to favor the opposite of what magazines delivered. They look for simplicity, for clean color schemes, and for themes that eliminate non-essential elements. The result is faster download times, improved navigability — and deeper engagement with users.\textsuperscript{21}

Mobile apps represent yet another view of the end user. According to the Pew Research Center’s \textit{State of the News Media 2015} report, 39 out of 50 surveyed news sites reported more traffic from
mobile devices than laptop and desktop computers. This finding encouraged publishers to focus on responsive design, creating sites that morphed in response to the device used to view them, ensuring that web content was deliverable to any device. No sooner than responsive design started to enjoy wide adoption, however, a new focus on apps that were designed especially for specific devices started to emerge. Popular publications such as The New York Times, Wired, and Time have produced dedicated mobile apps that employ a range of media and story formats to keep their readers’ attention.

Design, in this arena, emphasizes on-the-go sensibilities, which means organizing information into bite-sized chunks that can be swiped through easily and digested at a glance. In the past few years, the “best” magazine apps have been recognized for their social media features, the right balance of static and web-only content — and for design that captures the attention of the user.

Media design experts underscore the need for publishers to capitalize on all of the features embedded in the modern smartphone; this model blurs the line between user experience and design. Thanks to the kinds of usage data most smartphones routinely capture today, companies of all kinds are tailoring custom news deliveries (notifications) based on the patterns of a user’s typical activity. For example, GPS technology can track a user’s daily commute over time and predict when text would be a more desirable method of delivery (such as a subway where signals are weak) and when richer media formats such as video are preferred (such as their living room, where the signal is strong).

There have been several shifts in the evolution of design for the digital age, from simple replication to user experience-driven, hyper-clean interfaces, and now mobile apps are opening the door to more compelling eye-catching designs, and of a complete experience. Mobile apps provide designers not only with increasingly sophisticated tools, sensors, and network features that add to a rich user experience, but also a return to the appeal of the page.

**Analytics**

In the past decade, web analytics has grown from a simple traffic logging to include a range of sophisticated tools for usage data tracking, analysis, and reporting. Today, companies such as Google, Amazon, and Adobe leverage web analytics for activities including improving website and application design and user experience; optimizing e-commerce; improving customer orientation, acquisition, and retention; tracking and measuring success of actions, programs, and campaigns; and identifying problems to improve the performance of web applications.

Businesses are increasingly adopting new approaches that glean not only web data, but also data from mobile apps, video, and social engagement. Further, by leveraging a variety of statistical, modeling, data mining, and machine learning techniques to study recent and historical data, analysts can make more accurate predictions about future user behaviors. Since launching in 2005, Google Analytics has become the most widely used web analytics tool, and its latest version, ‘Universal Analytics,’ offers a flexible tracking code that can collect data from any device to follow a user across multiple devices and sessions, as well as the ability to customize dimensions and metrics to collect data that falls outside of the categories Google Analytics normally tracks.

Other major companies also have been developing their own data mining processes. Time Warner Cable, for example, uses the Adobe Marketing Cloud to create a unified profile of each visitor that mines Time Warner Cable data, in addition to second- and third-party data from partners. This allows the company to personalize content for consumers, including ads and special landing pages, based on factors such as household income and spending. Since implementing this approach the company has seen a 30% increase in conversion rate and a 47% increase in revenue per visitor, generating a $1.4 million increase in annualized revenue.
Such insights from analytics inform and drive the decisions and strategies of some of the most successful businesses, organizations, retailers, and publishers — and most recently, education institutions. With the widespread use of learning management systems (LMS) including Blackboard and Moodle, which amass large amounts of log data related to student activities, universities have become increasingly interested in analyzing the available datasets. Thus far, they are primarily using this data to support retention efforts. Administrative units, such as admissions and fundraising, remain the most common users of analytics in higher education today, but benefits of learning analytics can support the personalization of learning content, enhanced student motivation through immediate feedback, and data-driven curriculum and content design.

One of the earliest universities to demonstrate the value of learning analytics was Purdue University, who piloted its Course Signals project in 2007. The university combined data obtained from its LMS with predictive modeling systems to generate a real-time red/amber/green traffic light alert system that illuminated how students were progressing through a course. In Purdue's application, students exposed to the Signals alerts received higher grades and exhibited higher retention rates than those in the control groups. Analytics, when applied to education, can provide instructors and students a constant window into the efficacy of the course materials and how they can be fine-tuned for greater engagement and knowledge comprehension.
Course Apps in Action

While the use of mobile apps\textsuperscript{35} and digital textbooks\textsuperscript{36} has grown rapidly in recent years, many educators do not have the deep knowledge of web development and coding that has typically been required to develop sophisticated course materials. At the same time, they are often expected to create digital instructional materials for students that not only help them comprehend complex subject matter, but also capture their attention.\textsuperscript{37} Few faculty or staff have the levels of training needed to adequately incorporate web and learning analytics, nor do they have much background in design.

There is a need for user-friendly tools that empower faculty to design the kinds of compelling resources that will comprise the next wave of instructional resources and materials. When hundreds of students are often enrolled in a university-level introductory course, it is almost impossible for instructors to track and cater to individual learner needs as they progress through activities leading up to major assignments. If developed effectively, digital materials with built-in analytics can identify how well students are performing and pinpoint where they are struggling.\textsuperscript{38}

Course apps are positioned to address these challenges by incorporating the latest easy-to-use development platforms, content creation tools, and analytics that enable instructors to efficiently design sharp and impactful digital course materials, regardless of their technical expertise. Adobe's course app toolset, Adobe Digital Publishing Solution (DPS) and components of the Adobe Marketing Cloud and Adobe Creative Cloud, are already helping instructors at higher education institutions generate engaging course apps.

In the past year, American Public University System and University of Texas at Austin have launched course apps that capitalize on developments in all four of the areas described in the previous sections. Both institutions took advantage of the capabilities of the Adobe toolset, advancing an emerging collection of highly mobile, engaging course materials in which the design is sleeker, smarter, and more interactive. The developers at both institutions used an innovative combination of Adobe services to build course apps that reflect forward-thinking design and increased mobility, while gleaning critical educational insights for both instructors and students.

### Adobe Course App Development Tools for Universities

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<th>Digital Publishing Solution</th>
<th>Creative Cloud</th>
<th>Marketing Cloud</th>
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<td>DPS enables users with no coding experience to seamlessly create, publish, and disseminate their content in the form of mobile applications, and includes Adobe's Creative Cloud and Marketing Cloud.\textsuperscript{39}</td>
<td>The Creative Cloud provides leading desktop and mobile apps and workflows, including InDesign and Illustrator, which help users to design and layout sleek and engaging content.\textsuperscript{40}</td>
<td>The Marketing Cloud allows users to manage and deliver digital content through Experience Manager while tracking how people interact with that content through Analytics, giving them deep insights on where learners need help and where content needs refining.\textsuperscript{41}</td>
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The insights they gained in the process are broadly applicable to most higher education institutions interested in capitalizing on opportunities arising in what has been a very traditional publishing environment. These approaches are giving their faculty and staff new tools to both build learning experiences and to understand how students use them.

**American Public University System (APUS)**

**MyCourses Apps.** Using Adobe Experience Manager within Adobe DPS, APUS’s goal has been to reinvent online learning for their students at both American Public University and American Military University, who represent all 24 world time zones. With such a globally dispersed student
population, access to high-quality online experiences is critical, and APUS is continuously working to enhance the efficacy of their courses and course materials. MyCourses Apps reflect the notion that contemporary students expect these resources to match the visual punch and interactive capabilities of the latest social media platforms, publications, and websites they frequent outside of the classroom.

With a development team led by Phil Ice, Vice President of Research and Development at APUS, MyCourses Apps already encompasses six courses, including Homeland Security (HLSS154): Mind of Terrorist, and Music (MUSI200): Music Appreciation. The Adobe course app is allowing APUS to support and streamline the development of enhanced courses at scale, across various departments and disciplines.

**Figure 1: APUS Course Apps Home Screen with Course Offerings**

“Students are consumers just like any other, and we want them to be excited about our services. The reality is that they have a lot of alternatives when it comes to education,” says Dr. Ice. His team drew inspiration from how WIRED and Martha Stewart Living were developed on Adobe DPS, and the home interface of the APUS app makes each of the courses readily accessible and easy to navigate.

HLSS154 and MUSI200 immediately engage learners as they emulate the experience of reading a high-end magazine. Embedded video previews and interactive features, such as the Evolution of Media timeline and the “Twinkle, Twinkle, Little Star” song sheet, pictured below, allow clear points of entry for students.

**Figure 2: APUS Course App HLSS154 Lesson Overview and Interactive Timeline**
Finally, as students progress through the app, the chapters or sections often end with a quiz or another vehicle called a “knowledge check” to gauge how well they have grasped the subject matter. Adobe Analytics enable instructors to access this information and address any challenges specific learners — or the whole class — are having.

**Internet Learning Journal.** Course apps can also be used for the design and dissemination of academic publications. APUS used the Adobe course app tools to integrate a similar level of interactivity in their institutional journal, *Internet Learning*. This peer-reviewed journal was built using Adobe DPS, and Ice and team looked to Adobe Creative Cloud, including InDesign, for the
design and layout. Through the touchscreens on their smartphones and tablets, users can manipulate charts with complex data to get different views and visualizations on a subject to learn more information quickly.

**Figure 6: APUS Internet Learning Journal Interactive Charts**

The *Internet Learning* app is free in the iTunes app store and has received very positive feedback from students; it was Ice and team’s proof of concept for using Adobe solutions as the platform to build their course materials. As the scholarly record evolves, more academic journals can consider using similar techniques to make complex scientific content easier to comprehend and disseminate findings more broadly.

**University of Texas at Austin (UT Austin)**

The pathway for the Energy 101 course app began with a collaboration with the Public Broadcasting System (PBS). After Michael Webber, Deputy Director of the Energy Institute and Associate Professor of Mechanical Engineering at UT Austin, taught the course “Energy at the Movies,” it caught the attention of producer Juan Garcia. Together, they pitched the concept to PBS with the goal of turning it into a show. After the show aired, it provoked new thinking around how an energy course could be approached at UT Austin. Webber had been largely dissatisfied with the current state of energy textbooks and wanted to create a digital textbook that could be customized with compelling content. Using Adobe Creative Cloud and DPS, Garcia, Webber, and team launched the Energy 101 course app in August 2014 after just six weeks of development.

**Figure 7: UT Austin Energy 101 Course App Overview and Introduction Opener**

“People are already familiar with textbooks and tablets,” notes Garcia. “Here’s a chance for us to give them something more — in a beautiful way with an emphasis on design. We created something modular and digestible, meant for international audiences.”
The mobile app, available for iPads and Android tablets, contains an entire massive open online course’s worth of videos, interactive widgets, and calculators — all accompanied by text authored by Webber. Adobe DPS allowed the development team to adapt any content in real time and automatically deliver updates to enrolled students. This is especially beneficial in the energy field where production numbers change annually.

Figure 8: UT Austin Energy 101 Course App Section Overview and Embedded Video Example

Built-in analytics of DPS have enabled Webber to track how engaged students were in the material. He could readily observe, for example, how much of a video each student watched or if certain students were not watching the video at all. He was even able to get a granular view of how long each student spent on a specific page.

Figure 9: UT Austin Energy 101 Course App Analytics Depicting Students’ Behaviors and Interactions
Conclusion

While course apps are still in their early days, the examples seen at American Public University System and University of Texas at Austin demonstrate their potential. These initial models are indeed exciting; however, they are far from being widespread in higher education. At the same time, they represent the kind of fresh thinking that is an excellent response to the concerns raised in the OECD’s report, *Students, Computers, and Learning.* There is still considerable room for innovation before educational technology lives up to its promise of transforming learning experiences and improving learning outcomes. The strong convergence of the major trends that is driving course app design offers a compelling direction for continued development.

What the past ten years have made clear is that the digitization of instructional materials is not the destination, but only the first step. Deep thinking and creative application of what we already know are required to creatively take advantage of the intersections between digital textbooks, mobile learning, design, and analytics to fathom new possibilities for instructional materials.

The convergence of the four trends explored here has generated new energy around the instructional resources, and the possibilities are undeniable. The hope is that this strategic brief will serve as a springboard for critical discussions around how course apps can facilitate more meaningful learning while providing educators with key insights about student progress and the efficacy of the educational content. Leaders can look to major technological developments in the consumer space — from the quantified self movement in which wearable technology such as Fitbit closely tracks users’ behavior to make them more self aware; to the latest wave of social media platforms, such as Snapchat, that completely forgo web features in favor of the app-only experience — for a sense of what the future might hold for educational technology.

Recognizing that this topic is still very nascent, the authors are committed to following developments in the course app arena over the coming months. In the winter of 2016, the NMC will be releasing a follow-up report that chronicles how further efforts around course apps unfold into the next year.
End Notes

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