
Evaluating “Just Right” in EdTech Recommendation Systems

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ABSTRACT

Continuing with the recommendation system progress presented at the 2018 KidRec Workshop, Age of Learning product, design, and research leaders are expanding their work on recommendation systems to include conversation across three different products: ABCmouse, Mastering Math, and ReadingIQ. Authors present a description of ways in which a “just right” system for one product may differ from that of another product, depending on the learning and experience goals of the particular platform. Products are evaluated in their current states and in light of future plans based on scales of dynamic content presentation, perceptions of a personalized user experience, and availability of content from which children can choose.

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KEYWORDS

Recommendation systems; edtech; early learners; personalization; agency; user analytics; adaptive learning

INTRODUCTION

Recommendation engines are typically viewed as a means of guiding user behavior by presenting content that is interesting, surprising, and/or useful [1, 2]. Today's children spend significant amounts of time engaging with content systems that include large amounts of variability, whether Netflix, Youtube, game portals, web searches, or other digital media repositories. Children's Media Thought Leader Jordan Shapiro comments, "From a multicultural perspective, the sheer quantity and variety of available media is a good thing...the narrative formulas are more diverse." He cautions, "that doesn't necessarily correlate to more wide-ranging exposure," citing the ways content pathways are auto-curated to keep the platform "sticky." [3] With content availability growing exponentially across digital media systems, the need for appropriately designed recommender systems for children becomes critical. The success of a digital system made up of a high volume of discreet content units is in large part determined by the user's ability to engage with desired content toward a given goal. Children's recommendation systems within educational technology (edtech) products add the dimensions of learning objectives, developmentally appropriate content, and child online safety protections.

This position paper extends the initial work presented by Age of Learning, Inc. at KidRec 2018 [4]. The initial challenge for members of the ABCmouse team was to begin considering the logistical issues and pedagogical stances involved in developing recommendation systems for Age of Learning's flagship children's learning product. Though content across the children's learning platform had grown considerably, the means by which content was made visible to young learners hadn't adapted to dynamically present "just right" activities through recommendation systems. Over the last year, ABCmouse designers and researchers have continued their work toward more personalized systems. However, ABCmouse is moving toward integration with Mastering Math, another Age of Learning product. Since last year, Age of Learning has also released ReadingIQ, a new digital library product that exists separately from the other products. This paper, as an extension of the work initiated a year ago, broadens the discussion to include multiple products, addressing definitions of "just right" through the lens of child product users.

ABCMOUSE, MASTERING MATH, READINGIQ

Now in its ninth year of product availability in the consumer-facing educational technology market, ABCmouse is both an online program and mobile app that makes playful learning content available to children between two and eight years of age. Developed within a "curriculum-first" production framework, the learning activities span content across academic disciplines, including reading, math, science, social studies, and health, with content delivery through videos, songs,



Figure 1: ABCmouse Classroom Screen.

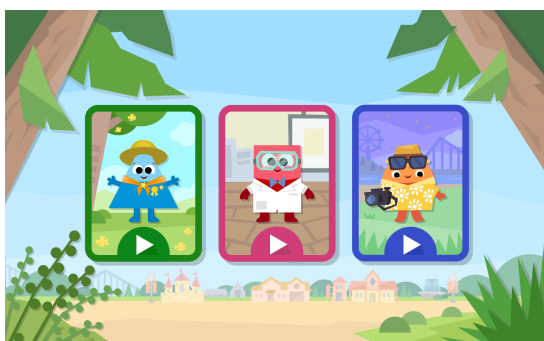


Figure 2: Mastering Math Activity Selection Hub.

games, puzzles, and art activities (Figure 1). All educational content is embedded in a larger metagame that includes pet care, shopping, avatar design, My Room personalization, and animal explorations. As described in the 2018 KidRec position paper,

interaction and curriculum designers have recognized not only the potential for improved user experience with a well-planned recommendation system, but also the role a recommendation system could play in overall content strategy and learning outcomes [4].

ABCMouse is also integrating more deeply with another Age of Learning product for early learners, Mastering Math. Mastering Math is a system of adaptive learning games designed to help children between Preschool and 2nd grade develop mastery of number sense foundations (Figure 2). The system is built on an evidence-centered framework of game experiences that relies on a tightly structured sequence of learning objectives and algorithms to determine what the student knows and has mastered, what the student does not know, and what the student is ready to learn next [5]. The system includes embedded assessments and feedback loops to make sure learners get needed support in challenging areas of math numeracy, but don't need to spend additional time in areas they've already demonstrated mastery.

Finally, in November 2018, Age of Learning launched a new and separate product—a digital library for kids between two and twelve years old. ReadingIQ includes thousands of books that have been curated and arranged based on reading level and categories. Available for both home and school, the system also allows parents and teachers to assign books and set challenges for readers (Figure 3, next page).

“JUST RIGHT” FOR KIDS

Children are the main product users across Age of Learning programs. The experience of the child must then be privileged higher than that of adults, even though adult instructional and experience designers path content according to tightly defined curation metrics. From the perspective of the child, their dominant need/expectation could be summed up as, “I want to enjoy my time with this product.”

Children sit at the center of their meaning-making processes, weaving together tools, texts, and contexts through activities and interactions to create new understandings [6]. Helping children make meaningful choices for playful learning requires providing them with the space and ability to demonstrate agency within a structure of appropriate options [7]. Defining what is appropriate for a digital learning system relies on applications of child development, learning science, and media engagement to hit an experiential sweet-spot.



Figure 3: ReadingIQ Personal Bookshelf.

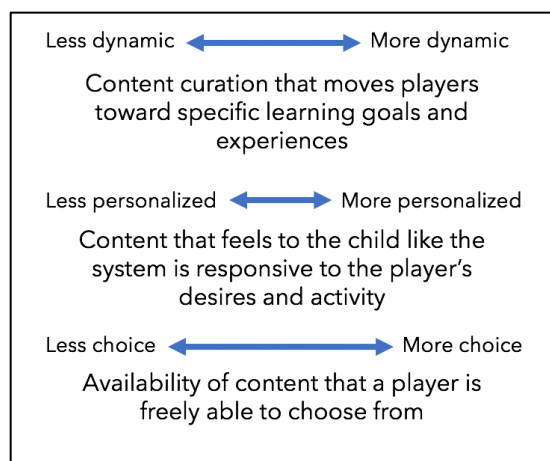


Figure 4: Content recommendation experience scales.

A learning product with both high algorithmic efficiency and well-designed user experience [8] requires that the content presented to children move them effectively toward learning goals through an optimized algorithm that responds to a child's individual actions while feeling personally engaging and meaningful to the child. Because content across products are tied to learning, increased user engagement leads to greater product "stickiness," which then results in prolonged exposure to educational content. With this in mind, what defines a content recommendation system as "just right" for children depends on the learning and experience goals of a product. In the case of the three Age of Learning products described in this paper, content recommendation systems currently exist in differing states, and product roadmaps will refine systems differently according to the unique goals of each platform.

SCALES OF EXPERIENCE IN CONTENT RECOMMENDATION SYSTEMS

ABCmouse, Mastering Math, and ReadingIQ all fall in different places on scales of experience in content recommendation systems (Figure 4). Each content system is the result of learning or experience goals, technical/development history, and functional use cases.

ABCMouse can be summarized as a portal that gives learners access to thousands of activities organized by academic topic, activity type, and grade level. Filtering systems are in place for classroom content topics to limit players to material specific to their grade level. Even with content filtered by grade level, academic topic, and activity type, the child still has access to a large amount of content choice. In addition, learners are able to "favorite" specific activities for later retrieval, which increases the personalization of the product, though not from a dynamic perspective. The ABCmouse pathing system ("The Learning Path") currently displays activities curated by educational specialists to build the learner's knowledge across academic disciplines, as opposed to responding to player performance or using adaptive pathing based on a child's own choices. Future plans for refining content discovery includes simplifying the ways content and activities are presented to learners and creating tighter links to suggested activities that will allow children to sequentially discover engaging content.

Mastering Math can be described as a highly pathed system of learning games with a back-end set of algorithms that are adaptive based on the learner's performance. The program is highly dynamic in moving players toward specific math learning goals. The result is a personalized system that works within a child's zone of proximal development (ZPD) [9] to be "just right" instruction. To keep a child at just the right place in their number sense development, a child is limited to three leveled activity choices at any given time. Content may feel personalized as the child remains in their zone of proximal development, but the experience is determined by algorithms and performance with little independent choice on the part of the child. The process of making content personal remains invisible to the learner. Future plans for Mastering Math include expanding the user experience to provide more choice and reward within the broader game system, balanced against the need to keep learning games limited and tightly linked to the child's ZPD.

ReadingIQ's avenues to reader content discovery will soon land in a sort of middle ground between the ABCmouse and Mastering Math approaches. With a product goal of increasing access to high-quality and high-interest books, the experience design of ReadingIQ aims to provide an environment in which children grow to love reading. In its current state, the entire library filters by a grade level, however, if there is a specific Guided Reading, Accelerated Reader, or Lexile level set by a parent or educator, the books at the desired range of levels are made available to the child via additional layers of filtering. A reader's personal bookshelf includes all recent books and the child's selected "favorites," as well as anything assigned by a teacher. As the product is a recent offering out of Age of Learning, time for the product to exist "in the wild" was required to generate a corpus of user data from which to recommend books to readers based on the activities and favorites of other children. Data is being captured as the product matures, and the product roadmap includes the application of machine learning to recommend specific "just right" content to readers. The other feature set to release in the near future is a reader level assessment, which will result in an auto-population of books at the appropriate reading level. Within the more robust recommendation system in ReadingIQ, the designers will strive to maintain a strong sense of cognitive challenge, agency for the child, and discovery learning [10].

CONCLUSION

ABCMouse is a content portal and metagame that aims to provide broad and rich learning experiences for children that are "just right" in terms of interest and learning trajectory, helping set them up for academic success. Mastering Math is an adaptive system of games that provide young learners with "just right" learning experiences in their ZPD, moving them toward mastery in number sense knowledge and skills. And ReadingIQ aims to increase the amount that kids read by providing them with "just right" books to choose from based on reading levels and areas of reading interest. Different product learning and user experience goals result in different definitions of "just right" as it relates to content recommendation systems. Product owners, designers, and researchers are coming together to continue refining recommendation system plans for each product, determining the placement that is most appropriate on scales of dynamic content presentation, personalized user experience, and availability of content from which children can choose.

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