Mobile First: A Trend in Virtual Learning Environments

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Abstract: Although mobile learning has long been predicted to become a vital part of the educational reality, schools often seem reluctant to implement mobile teaching solutions. In order to assess the current preferences of learning modalities for school students (ages 9-15) and teachers, an e-learning environments traffic data was analyzed. We have detected two trends: The first is a total rise of mobile usage, especially in comparison to the usage of desktop PCs in the past four years. Second, we have detected that especially students aged 12-15 mostly prefer mobile devices. Hence platform design should be adapted for better use with mobile devices to meet the learners' needs.

Keywords: Mobile devices, MOOC, Google Analytics, Attrition.

1 Introduction

With over 50% of all online page views being performed on mobile devices [St19], a primary focus of website design has shifted to from desktop PCs to mobile devices [PZ15]. The *mobile first* design is a philosophy in user interface design for websites, which states that the design should be created first (and optimized) for mobile devices [Mu15]. This philosophy has since been extended to responsive web design, where the platform, screen size and, recently, contexts adapt to the users' behavior [Mu15, PZ15]. Other solutions to the rising mobile trend, such as adaptive web designs or separate sites for mobile devices have also been implemented [CP17].

This trend is also developing in e-learning contexts, with a rise in mobile learning applications and websites [Wa15]. In current research, the technology acceptance model is often used to evaluate views of students towards so-called m-learning, meaning learning through a portable device, often smartphones or tablets. However, many researchers define m-learning in a broader sense, incorporating the mobility of technologies, the mobility of learners, of educators and of learning itself [AES16].

In the examination at hand, user data from a German virtual learning platform (Mathe im Advent, short: MiA) was evaluated. MiA offers an annual prize competition in the form of an advent calendar for students who correctly solve 24 mathematical tasks on 24

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consecutive days in December. Teachers are encouraged to use MiA with their students and to compete in so-called class-competitions, where the entire class participates in the competition as a unit. In 2019, 45% of all users participated as part of a class in the class-competition. To access all features of the class-competition, a small fee must be paid, whereas participating as a single user is free. The virtual learning platform consists of two formats, one for children in grades 4-6 (ages 9-12) and one for children in the grades 7-9 (ages 12-15). Moreover, the MiA website is in a grey area between formal and informal learning, since partially, it is used by teachers (using, e.g., print-outs of the tasks) as a part of their curriculum. This platform implements a responsive web design based on CSS media queries and is thus usable both on desktop PCs, as well as on mobile devices. To examine the current state of usage for different devices, specifically in a learning environment, user traffic data from Google analytics was analyzed.

2 Background: Mobile Learning

With the progressing digitalization arriving in schools among many other areas, the demand and offer of learning options for mobile usage rises [Sh09]. With mobility and context as the main objects of analysis, theoretical frameworks of mobile learning have been published [AH07]. Some predict that mobile learning has the potential to become a new generation of distance learning [ZBD09]. In a survey of 88 educators across different countries, 78% of respondents believed that mobile learning will be essential to mainstream higher education within three to five years [ZBD09].

Using the wide range of options for task presentation and feedback, such as images, videos, or sounds available on tablets, as well as the adaptability of data-based learning environments, early adopters of these technologies hope to achieve improved learning contexts for students [FM20]. Apart from the personalization of learning environments, m-learning environments often offer parallelized social interactions between students, as well as students and teachers [Ke12]. These types of collaborations fall in line with the necessity of conversation in teaching and learning known from socio-cultural theory [Vy78].

In order to examine the educational reality of m-learning, the technology acceptance model (TAM) is often used to indicate the willingness of stakeholders to implement m-learning. The results of a systematic review by Al-Emran and colleagues indicate that the majority of these articles deal with the acceptance of m-learning among students [AMK18]. As digital natives, young students often appreciate mobile settings for educational purposes [PB11]. The two main indicators for behavioral intention of use, as suggested by the TAM model, are the perceived usefulness, as well as the perceived ease of use, which has also been confirmed in an m-learning setting [Al15]. Furthermore, it seems as if the usage of mobile technologies itself has a positive influence on the motivation of students [PGW08].

When examining the educators' attitude toward m-learning varying results were found.

One study found that younger female respondents were more engaging in m-learning resources [CC14]. Another study found that while the majority of teachers have a passive stance when it comes to the introduction of mobile technologies in classes, the likelihood of a progressive stance rises with their familiarity of the possibilities and potentials [FM20].

There are also concerns when it comes to mobile usage in educational contexts. The use of mobile devices in online social networking parallel to the completion of school work activities has been found to be disruptive [JC12], by using cognitive capacities of students. When it comes to m-learning in mathematics, approaches of self-directed and game-based learning have been implemented [Eb15]. However, collaborative learning scenarios, as required by the socio-cultural theory, are still very rare, which is likely due to the complex programming efforts and necessary environment to implement it [Eb15].

3 Method

The devices used for accessing the MiA webpage during the seasons of 2015 - 2019 were analyzed based on Google Analytics data. For all user sessions (meaning durations of uninterrupted usage of the platform) three types of devices were distinguished: desktop PCs, mobile phones and tablet devices.

In the first step, a list of URLs, which were of interest, was created. In the MiA environment, specific URLs are targeted towards specific users. Teachers, for example, are presented an overview of their classes achievements via a teacher-specific URL. As for the URLs leading to the tasks of the students, these are all labeled as “4-6” or “7-9”, indicating the presumed school classes, from which the respective age groups may be deduced, of the users. From internal data, it is known that the overwhelming majority of the users are students, and not teachers. Therefore, we assume the influence of teachers looking at the student tasks to be negligible and interpret the views of the task- and submission-specific URLs as student usage.

In the current analysis, URLs were split into 6 groups:

- Teacher-specific URLs, where the teachers overview classes between 4-6
- URLs leading to the sites where a task for classes 4-6 is displayed
- URLs where a task for classes 4-6 has just been submitted
- Teacher-specific URLs, where the teachers overview classes between 7-9
- URLs leading to the sites where a task for classes 7-9 is displayed
- URLs where a task for classes 7-9 has just been submitted

For each of the specified URLs, the absolute and relative numbers of sessions were determined. For each session, it was specified whether a desktop PC, a tablet or a mobile phone was used.

4 Results

Between the years 2015 and 2019, the virtual learning platform experienced a growth in absolute sessions per day. Furthermore, the percentage of mobile devices used for these sessions grew. Between the seasons of 2017 and 2018, the mobile usage overtook the desktop usage of the website as the most frequently used medium for MiA, as visible in Figure 1.

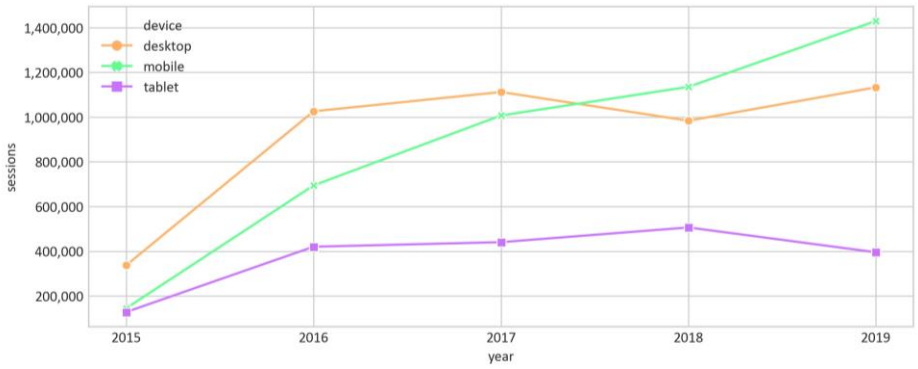

Fig. 1: Number of sessions per year, between the years 2015 and 2019, split by different devices.

It turns out that device usage differs between students and teachers (Figure 2, left). In 2019, teachers preferred desktop PCs over mobile devices for accessing MiA, students used both desktop PCs and mobile devices in a balanced way, with older students showing a slight preference for mobile devices instead over tablets.

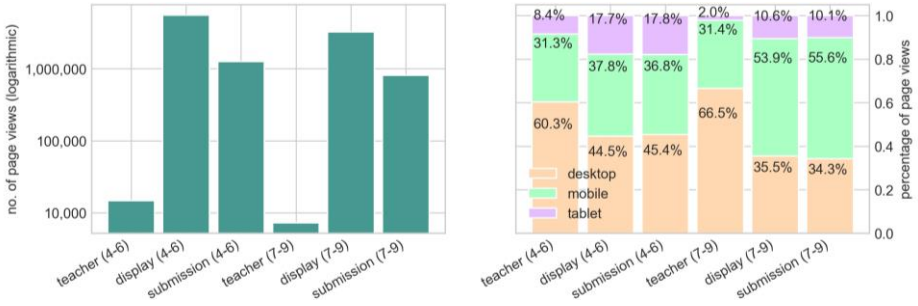

Fig. 2: Left: Average number of sessions (per task) on display or submission sites of the tasks for classes 4-6 and 7-9, separate for teachers. Right: relative numbers of sessions on different devices by teachers and students of classes 4-6 and 7-9.

As can be seen on the right in Figure 2, mobile devices were preferred for displaying tasks. When submitting the tasks, this relation shifted towards desktop PCs for the younger students (grades 4-6). While the usage of desktop PCs also increased, the students in grades 7-9 largely submitted the tasks via mobile devices.

5 Conclusion

All in all, we have confirmed that the trend of website usage on mobile devices rises, also in an educational context. Specifically, we have detected a rise of mobile usage over the past five years, which overtook the usage of desktop PCs.

Secondly, we have seen that teachers present a different media behavior than students. The prevalent use of mobile devices for displaying and submitting e-learning tasks was especially visible for students of grades 7-9. There were no notable differences in the preferred devices between the display and the submission of the tasks.

We conclude that, especially for the age group of 12- to 15-year-olds, mobile devices have become a predominant medium for e-learning content. The practical implications of these findings are that the differing needs for optimal usage of teachers and students must be involved in the design process of e-learning materials, for example in the forms of responsive or adaptive website design. Furthermore, learning content must also be adapted for optimal mobile usage in the case of 12- to 15-year-olds.

As an outlook for further research, one could further distinguish between the user groups by applying attribution modeling and tag management within Google Analytics. This would yield more insight about the contexts and further activities of the learners.

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