Summer 2021

Usage Patterns of an ePortfolio-Platform - On the Potential Conflict between Short- and Long-term Usage Scenarios of ePortfolios

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Abstract

ePortfolio-platforms are popular tools to facilitate and promote lifelong learning. One of their major usage scenarios is enabling users to document their learning outcomes in an institution-independent way beyond formal learning settings. Aside this, ePorfolios are also promoted as a way to facilitate qualitative assessment in courses. The latter scenario introduces a short-term usage perspective that can be counterproductive for establishing sustainable long-term usage practices. In this paper, we analyse the usage data of the ePortfolio-platform mahara.at with respect to the prevalent usage patterns. This instance was active from 2007 until 2019 and featured more than 22.000 users from nearly 200 different institutions. As part of the analysis, we reviewed the activity on the platform on the basis of users' login behaviour and content creation activities. Activity data shows that ~ 50% of the users used the platform for only half a year and sustainable usage practices over longer durations of time can hardly be observed. Both logins and content creations show cyclic patterns which correspond to the academic year. Based on these indications we conclude that users used the instance mainly for course-based scenarios rather than as a lifelong-learning portfolio.

Keywords: ePortfolio, usage patterns, Mahara, lifelong-learning.

1. Introduction & Related Work

ePortfolio-platforms are popular tools to facilitate and promote lifelong learning by documenting and disseminating individual learning achievements (Fisher et al., 2014). Around 2010, research about and the implementation of ePortfolios in learning have begun to flourish (Bryant & Chittum, 2013). A central promise of ePortfolios is to support learners in their journey from formal learning in schools, universities, and continuing education to non-formal learning (Balaban et al., 2011; Thibodeaux et al., 2017). It was claimed that ePortfolios will engage students to continue learning and work on their portfolios after leaving their respective educational institutions, thus enhancing LLL from a technology perspective (Balaban et al. 2011). Therefore, the hope is that this tool also enhances personal skills such as self-regulation and cognitive monitoring (Scully et al., 2018).

As a central concept of ePortfolios, learners create digital artefacts representing their learning efforts using a (usually) web-based platform, which provide a way for teachers to qualitatively assess learners's achievements. Conceptually, there are only a few restrictions on the type and shape an artefact can take (e.g., (hyper-)text, picture or an arbitrary binary file). In addition to studying and teaching purposes, artefacts can represent employment history (Scully et al., 2018) and serve as institution-independent documentations of past learning achievements (ibid.). Consequently, an ePortfolio can also serve as a CV (Balaban et al., 2011). Furthermore, some ePortfolio platforms allow students to create goals, which can be used for tracking learning effort (Buyarski et al., 2015).

This broad field of targets pursued by ePortfolios are potentially problematic in shaping users' expectations and intentions of use, in particular when contrasting short-term usage scenarios such as assessment for a single course (Hallam & Creagh, 2010) with longer-term scenarios such as creating a structured portfolio of learning outcomes (Prastiwi et al., 2020). The activities required to meet the

assessment criteria in a single course likely do not lead to the development of sustainable and consistent usage practices, which would be beneficial for longer-term usage (Hsieh et al., 2015).

Recent studies by Bollinger and Sheperd (2010), Prastiwi et al. (2020) and Douglas et al. (2019) all report positive attitudes and responses of students towards electronic portfolio creation and usage of portfolios for assessment. They also indicate willingness for longer-term use, but do not investigate whether persons are following their proclaimed intentions. Mobarhan & Rahman (2014, 2015) investigated the continuance intention of users using a theoretical literature derived model based, among others, on the self-determination theory (Ryan & Deci, 2020) highlighting satisfaction as the most influential factor. Yan et al. (2012) stress the importance of habitual use for continuance intention. Chen et al. (2012) link user motivation for continued use of ePortfolios to perceived usefulness, in particular for learning and career development. However, none of the existing studies has explicitly investigated whether continuance intention actually leads to continued use, i.e. overcomes the intention-behaviour gap (Bahattacherjee & Sanford, 2009; Yan et al., 2021).

In our current project, we aim to contribute to closing this research gap by providing evidence on usage patterns from an institution-independent ePortfolio platform. We hypothesize that didactical scenarios for ePortfolio use in formal educational settings (Hallam & Creagh, 2010), which is often related to qualitative forms of assessment (ibid.), might lead to usage behaviour that, despite all good intentions, lead to unsustainable long-term usage scenarios.

Consequently, in this paper we aim to answer the question: Which usage patterns do users of an ePortfolio platform exhibit and are they in line with the hypothesis of an intention-behaviour gap? We set out to explore the usage patterns of ePortfolios in a structured way by examining data collected during the operation of mahara.at. Mahara[1] is one example for an ePortfolio software. Its development started in 2006 and the software is still maintained and developed as of 2020. In an attempt to facilitate institution-independent usage of ePortfolio software and promote long-term development of individual portfolios, the Mahara-instance mahara.at was established in 2007 as an openly available platform. It was promoted in Austrian educational institutions on all levels to allow for wide dissemination and gained nearly 22,000 users over its 10 years of active operation (registration was ceased in 2017, and the platform was replaced with a new version of Mahara in 2020).

The remainder of this paper is structured as follows: In the next section, we describe the metrics in platform usage patterns that can be used to distinguish short- from long-term usage scenarios based on the data captured by the Mahara platform. In sections 3 and 4, we present evidence on these metrics derived from the usage data of mahara.at from 2007 to 2019, covering the activities of about 22,000 users from nearly 200 different institutions. In the final section, we discuss the results in the light of our working hypothesis and outline paths forward for developing strategies for sustainable ePortfolio use based on the found evidence.

2. Methodology

In our attempt to examine usage scenarios that were implemented using the ePortfolio-platform mahara.at, we have analysed the data Mahara keeps in its database by default about user activity and content creation. The database of the examined instance holds data from mid 2007, when the platform was made publicly available, to mid 2019, when it was replaced by a new instance and shut down. The data was preprocessed by the technical administrator of the platform before handing it over to the researchers for analysis, removing all personal data that would allow identifying individuals. Data was pseudonymized to allow for tracking of user activity over time. Furthermore, all content created by users was removed for analysis, only metadata (e.g., creation dates, ownership, etc.) was kept for analysis.

1 https://mahara.org

Consequently, our analysis of usage patterns is based on two sources: statistics about users and their login behaviour and statistics about artefact creations of users. As the data is pseudonymised, no data privacy issues arise. Data was processed using R 4.0.5.

At the time of shutting down the examined Mahara-instance on mahara.at in 2019, a total of 21.929 users were registered on the platform. Most of these users were assigned to one of the 197 institutions that were registered on the Mahara instance – open registration for users outside educational institutions was available, but hardly used. However, accounts were not suspended after users left their original institution (i.e., were removed from their respective groups by institution admins), but remained active, providing them with the opportunity to use their portfolio beyond the original context of introduction. The institutions were different forms of K12 or K13 schools, technical schools and universities, and stemmed from five different countries (Austria, Bulgaria, Czech Republic, Germany and Turkey), with a focus on Austrian institutions.

User login behaviour is used as a metric to determine usage patterns, as, in order to perform any activity on Mahara, users are required to log in to the website. Mahara provides aggregated statistics of this behaviour for every day. Based on these statistics, the level of engagement and in particular when it was happening with which magnitudes can be estimated and serve as a foundation for interpretation. Data on user logins is only available from late 2010 after an update to the platform software included logging of this information.

To examine the usage patterns more in-depth than is possible based on aggregated login data, the engagement of users with the platform in terms of *content creation* was examined on two levels. First, we analysed content creation patterns over time from a platform perspective, i.e., not examining individual user behaviour. This allows to determine the *overall magnitude of and changes in content creation*, which can be put in relation with users' login behaviours, providing a basis for examining whether active content production or passive consumption is the prevailing user behaviour.

Furthermore, since the activity period of users differs and also the number of users on the platform differs over time, we also investigated *individualised content creation patterns*. For this purpose, we defined the life cycle of a user to be the period between the first and last activity (e.g., user profile creation, creation of an artefact) on the instance and computed the amount of content created with the discretised continuum of this life cycle. This analysis has the potential to highlight differences in behaviour changes over time.

3. User Structure

3.1 Users on the platform & development over time

Mahara provides aggregated login statistics for every day, i.e., stores the number of unique logins per day as a single number (note that this data is only available from 2010 after a platform update enabling logging here). As can be seen in Fig. 1, the number of logins per day followed a cyclic pattern repeating in 12-month-cycles with low points mid-year and peaking activity around February/March each year. Login patterns remained largely stable between 2012 and 2014 (the single peak in 2014 is of unclear origin). Logins start to decline from 2015 on, but exhibit a similar pattern as in the initial years of operation. The cessation of user activity in 2018 can be explained by the transition to a new Mahara instance and the continuous migration of users to it, which was finished by 2019.

Furthermore, we investigated how user activity developed per weekday over the cycle of a week (cf. Fig. 2). Users were active during the whole week with no drastic differences between the weekdays, except a drop of user activity on weekends, in particular on Saturdays. This drop is statistically significant (double-sided t-test, $p<0.001$) showing that users logged in less often on Saturday and Sunday and, moreover, on Friday, users logged in less frequently than on Monday and Tuesday (cf. Fig. 3).

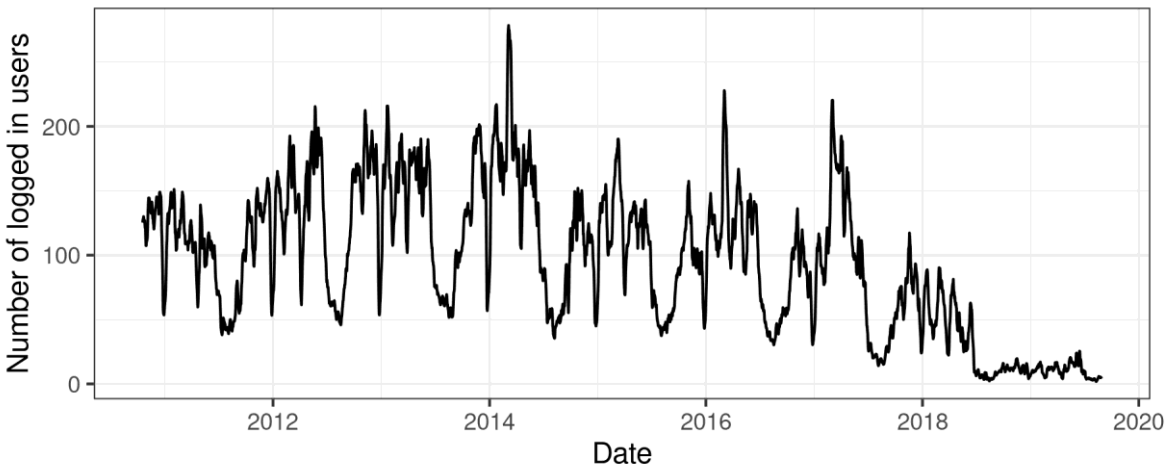

Figure 1: Development of daily logged-in Users. Y-axis displays a seven-day rolling mean.

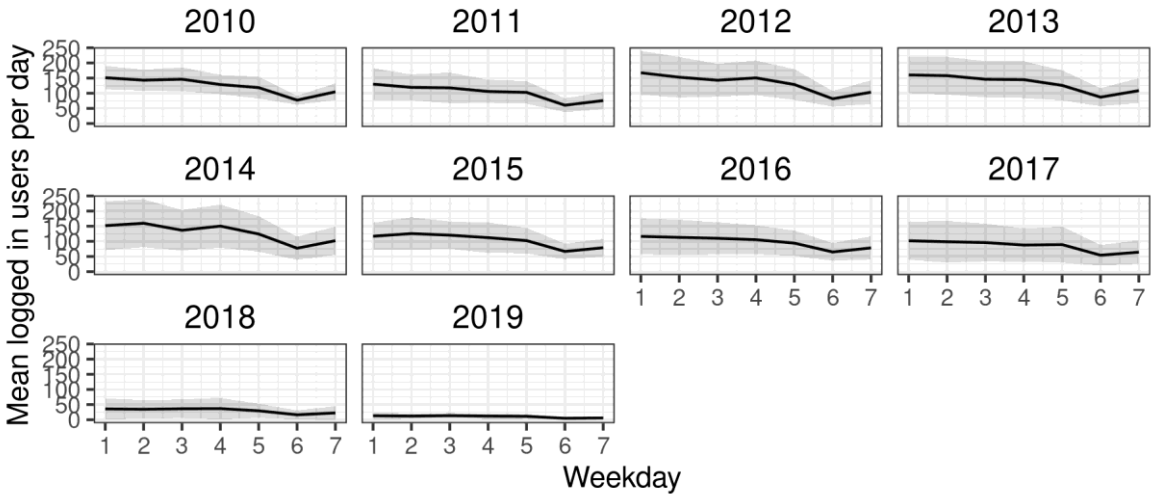

Figure 2: Average logged-in users per Weekday (1 = Monday, 7 = Sunday). Line shows the average value for the respective day, shaded area represents the standard deviation.

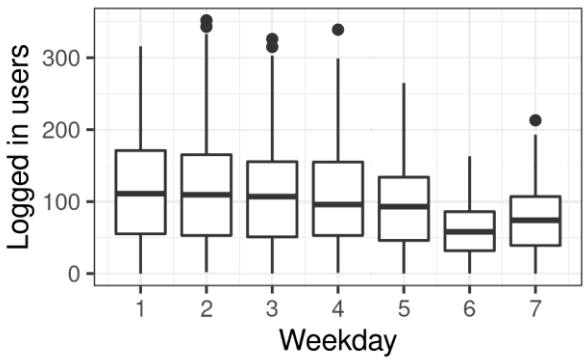

Figure 3: Mean logged-in users per weekday (1 = Monday, 7 = Sunday).

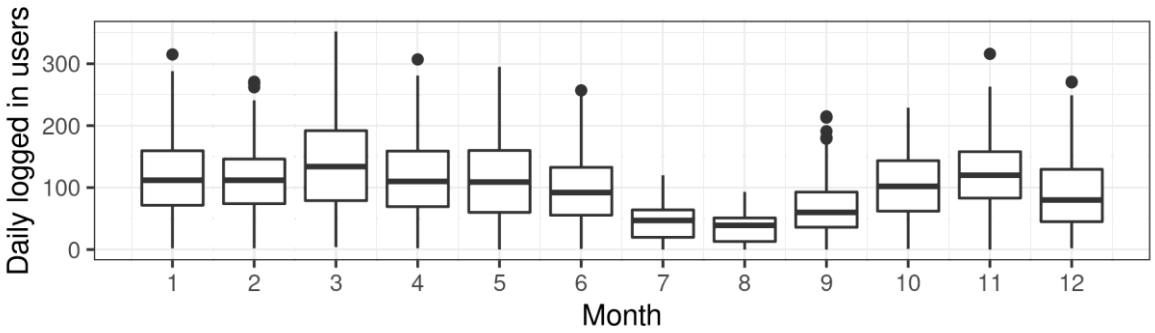

Figure 4: Mean daily logged-in users per month.

We furthermore analysed differences in login behaviour between calendar months to further explore the 12-month-patterns, that are visible in the overall login graph in Figure 1. Several significant differences between the amount of daily logged-in users per month have been identified (cf. Fig. 4). University- and school-years in Austria, were most users stem from, are usually organised in two terms: a fall term starting in September for schools, October for universities and a summer term starting mid-February for schools and March for universities. A peak in logins is visible in March, largely corresponding to the start of the summer term. The drop of logins in July and August corresponds to the summer break of educational institutions. Logins rise again in the months corresponding to winter term, with a peak occurring in November.

3.2 Activity Duration

As described above, ePortfolios can be used for heterogenous scenarios which differ in the duration the portfolio is maintained by users. mahara.at is offered as an institution-independent ePortfolio-platform with the intention to facilitate long-term use, but still was largely introduced as a platform to users in educational institutions. We thus examined whether these introductions led to sustainable use of the platform for prolonged periods of time, which would indicate the willingness of users identified in related studies of Prastiwi et al. (2020) and Douglas et al., (2019) to use an ePortfolio as a life-long learning instrument. Therefore, we analysed the period for how long users have been active on the platform. For this analysis we computed the time span between the first recorded activity on the platform and the last login or activity. More than half of the users in the database (n = 12.472, ~ 57%) used Mahara for less than half a year. As can be seen in Figure 5, the number of users for a given activity duration decreased exponentially (the y-axis of this figure is log-scaled in order to better highlight exponential decline).

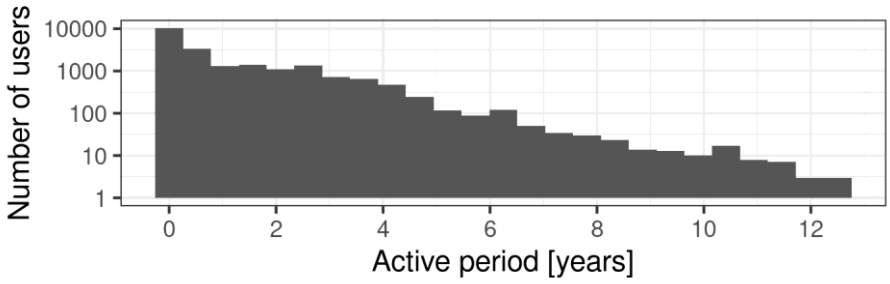

Figure 5: Histogram of the active period of users. Y-axis is log scaled.
Data is binned into half-year steps.

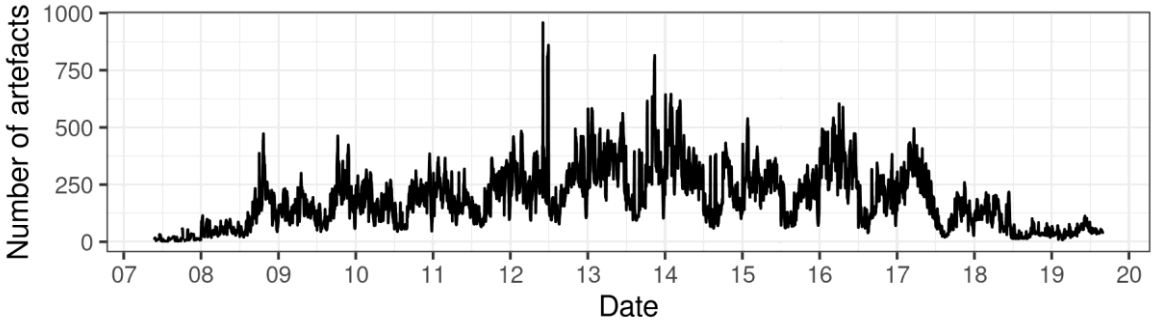

Figure 6: Development of artefacts created per day (7 day rolling mean).
X-axis denotes years 2007 until 2019.

3.3 Interpretation

Summarising the findings from login and activity data, we found evidence that the use of mahara.at was largely shaped by deployment in formal (i.e., institutional) educational settings. The fact that users have been significantly less active on the weekend than during the week and activity has varied along the progression of school/university terms, gives rise to the hypothesis that the Mahara instance was largely used in the school/university context for short-term usage scenarios, such as qualitative assessment. Furthermore, the fact that more than 50% of users have been active on the platform only for a short period of time (less than half a year) also provides evidence for the prevalence of short time usage scenarios, which did not lead to sustainable use of the platform after they have completed the assignments which has brought them there.

4. Content Creation on the Platform

Mahara allows users to create different forms of content: As its central content category, Mahara allows creating and storing arbitrary data as so-called artefacts using a plug-in system. Examples for these artefacts include blogs and blog-posts or files uploaded to the platform. These files can then be used not only in blog-posts but also in other content forms, for example sites representing a description of a task, which are usually stored in HTML format. Furthermore, users can create forums and posts in them in order to facilitate exchange among users.

4.1 Artefacts

In analogy to the analysis of user logins described in section 3.2, the development of artefact creation over time was analysed. As can be observed in Figure 6 also this aspect followed a cyclic pattern. The login activity and artefact creation declined in similar patterns, indicating that users' logins largely were linked with content creating activities.

The mean artefact creation per month also follows a pattern similar to the pattern of user logins described above: Users are less active during "vacation months" than during the rest of the year (cf. Fig. 7). During July, August and September fewer artefacts than during the rest of the year were created. Moreover, artefact creation was lower in December.

Artefact creation per weekday (cf. Fig. 8) again follows a pattern similar to user logins: activity seems to be higher during the week and dropping over the weekend. On weekend days and Friday, significantly fewer artefacts were created than during the week.

4.2 Forums

Posts in forums followed a pattern similar to user logins and artefacts, but on much lower quantitative level: yearly cycles repeated with (cf. Fig. 9). Several peaks indicate days on which posting activity was

unusually high. Still, the number of artefacts created per time unit approximately is at least one order of magnitude higher than the number of forum posts, indicating that the platform was largely used for content production purposes rather than reflection and exchange on already available content (for which usually forums would be used in Mahara).

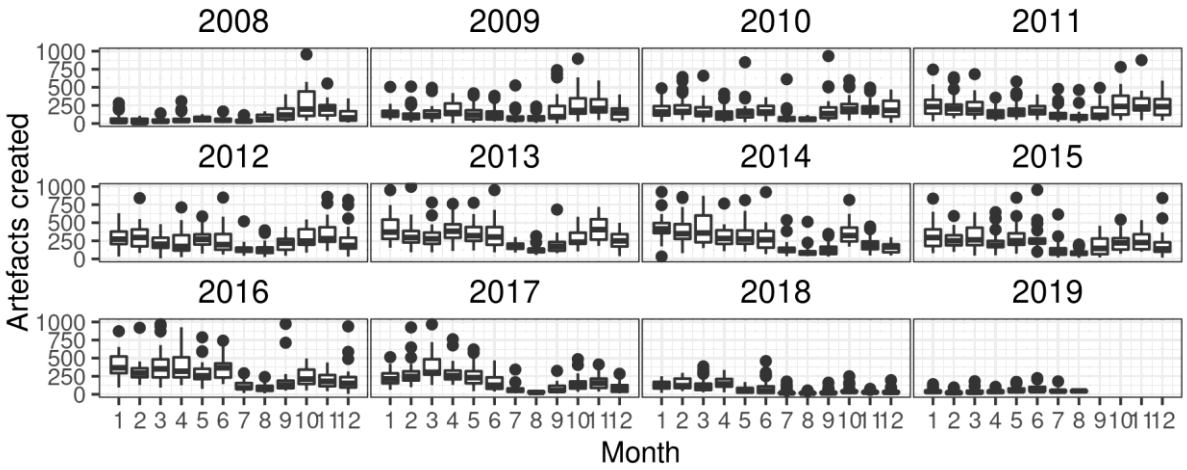

Figure 7: Artefacts created per month.
Note that 10 outliers were removed from the plot for clarity of presentation.

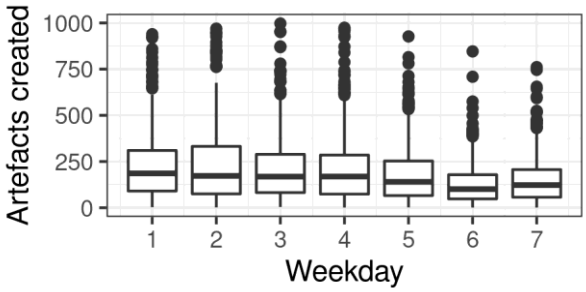

Figure 8: Artefacts created per weekday.
Note that 10 outliers were removed from the plot for clarity of presentation.

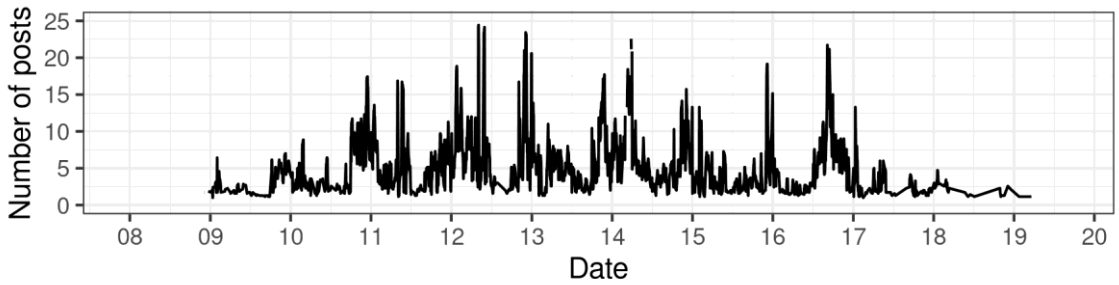

Figure 9: Posts created per day (7 day rolling mean).
Note that outliers were cropped from the path for clarity of presentation.

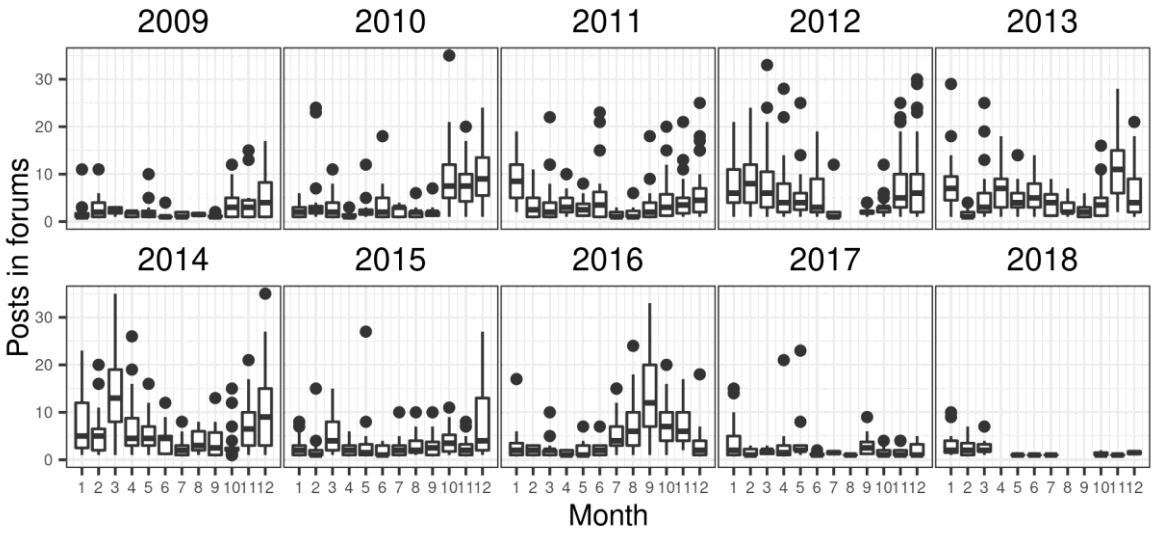

Figure 10: Mean number of posts created in a month.
Note that some outliers were removed for clarity of presentation.

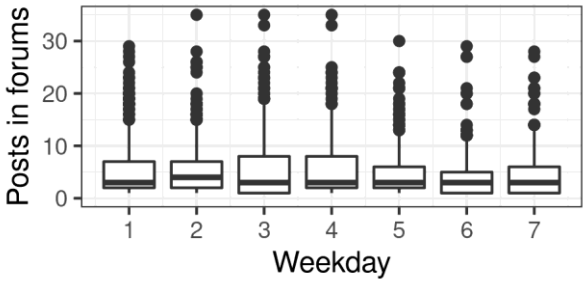

Figure 11: Number of posts created per week day.
Note that seven outliers were removed from the plot for clarity of presentation.

In contrast to the patterns of user logins, only a few differences in numbers of created posts between months were found (cf. Fig. 10). For example, posts in February (4.54 ± 5.09) differed from those in March (8.07 ± 15.0) and December (7.75 ± 8.27). Furthermore, posts in March were different to all other months except January (5.70 ± 5.73), November (7.26 ± 7.42) and December. Posts during the vacation season in July (3.15 ± 2.84) and August (3.91 ± 3.74) were different to posts in November and December.

Moreover, during a week an increased number of posts compared to weekends were found: Wednesdays (7.09 ± 11.2) differed from Fridays (4.90 ± 6.65), Saturdays (4.08 ± 4.43) and Sundays (4.5 ± 4.76); and furthermore, Thursdays (6.13 ± 7.19) differed from Saturdays (cf. Fig. 11).

4.3 Content Creation in the Activity-Duration of a User

In order to examine the development of content creation, we defined the activity-duration of a user to be the period between the first and last activity (e.g., user profile creation, creation of an artefact) on the instance. These durations then were normalized to an interval [0..1], where 0 indicates the start of the activity period and 1 indicates the end of the activity period. The number of activities were summed up in increments of 5% (0.05) of the respective activity duration and also represented as a fraction of the overall amount of created content in the respective categories. We then segmented the user population in

two parts: those who were active for half a year or more (n = 9.457) and those you were active less than half a year (n = 12.472) to identify potential differences in usage behaviour.

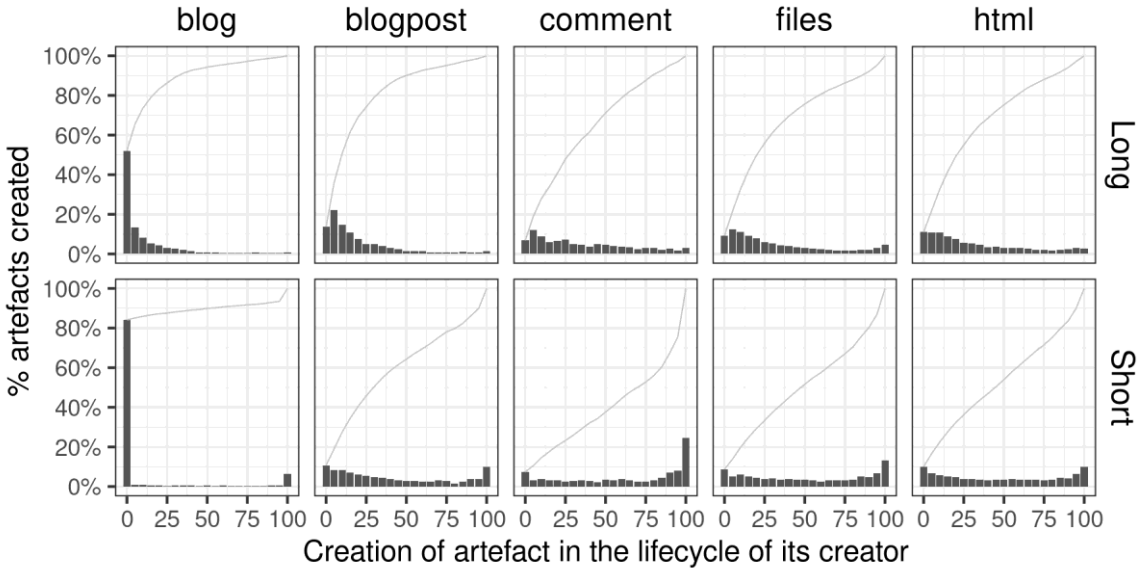

Figure 12: Artefact creations of users active on Mahara. Upper part shows users active for half a year or more, lower part shows users active for less than half.

As can be observed in Figures 12, short-term and long-term users differ with regard to their usage of Mahara. As is observable in the lower part of the figure, persons who use Mahara only for a short period of time showed peaks for creation of artefacts during the last five percent of their active period. This means that immediately before they stop using the platform, they create a majority of their comments and create a large proportion of their files and content. Long-term users lack that final peak, but create most of their content over an extended duration of time usually with an emphasis in the first third of their activity period.

4.4 Interpretation

The findings with respect to content creation also found evidence that mahara.at was used in large parts in an institutional learning setting rather than as a personal tool for life-long-learning. This is based on the fact that, similar to login behaviour, the amount of creation activity largely follows the patterns of school or university years and furthermore, that users have created less content on weekends. The observation that short-term users show content creation spikes in their final days of activity (the final 5%-bin equals about 1 one week for people having been active for about half a year) can be interpreted as activity that is necessary to meet course requirements for assessment. For longer-term users, such activity spikes cannot be observed – they rather show declining usage activity, indicating that users active more than half a year usually do not develop sustainable content creation activities and eventually cease to actively use the platform as a way to document their learning experiences.

5. Discussion & Conclusion

Data from our study suggest that a majority of learners stopped using Mahara as a platform for their ePortfolio immediately after the course / study program in they have been introduced to it. This is in contrast to findings a study by Balaban et al. (2011), in which continued usage ePortfolios platforms was reported and from which the authors derive the hope that ePortfolios could be used as sustainable tools for learning documentation.

In their study Bollinger and Sheperd (2010) reported that students had the intentions to continue using the ePortfolio platform after their respective course. Although, intentions are not covered as part of our study the results give no evidence for a broad realisation of such intentions, pointing at a potential intention-behaviour gap (Bhattacherjee & Sanford, 2009).

Based on the findings of this study it can be concluded that the usage patterns of the analysed Mahara instance were not reflecting expectations for a sustainable long-term use as an ePortfolio platform, but rather as a platform for short-term usage scenarios such as assessment purposes or – in some cases - as an in-class communication platform. The findings of our study, however, suggests that even for such scenarios, content creation and communication is not driven by users' needs, but rather by external pressure such as submission deadline. This is based on the observation that short-term users seem to create a large proportion of their comments and content just before their departure from the platform.

We hypothesize that the didactical approaches behind these usage patterns prevent users from developing an understanding of the potential added-value ePortfolios could provide to their professional and personal development and thus lack a sense of relevancy and importance for integrating the use of ePortfolios in their learning activities, and thus form unsustainable usage habits (Chen et al., 2012; Yan et al., 2021). Such a sense of relevancy and importance, however, is the prerequisite to develop self-determined usage patterns (Ryan & Deci, 2020) that survive the removal of external demands and lead to sustainable usage (Mobarhan & Rahman, 2015). As a consequence, we question whether the "dual-use"-approach (implementing short-term-scenarios while providing users with the opportunity for long-term-use) when introducing ePortfolios in institutional learning settings is an appropriate way for users to develop sustainable usage practices.

The study presented here has examined the usage of ePortfolios from a bird-eyes-view using data from an over 10-years-deployment of Mahara in the institution-independent instance mahara.at. The study is limited by the fact that only meta-data on platform usage was analysed, which leads to certain constraints in its interpretation. The actual content created on the platform could not be examined in detail, neither could potential different roles of users (e.g., students, teachers). Furthermore, the underlying reasons for the behaviour could not be studied due to the design of the investigation (data-based). The overall patterns still provide clear indications that mahara.at was mainly used for course-based scenarios despite its aspiration to provide a platform for long-term development of one's own lifelong learning portfolio.

Our future research will examine these usage patterns in more detail to develop a better understanding of how it was used by individual users, providing the foundation to identify usage patterns that are linked with sustainable content creation. This will provide the foundation to eventually derive suggestions on how ePortfolios can be introduced to inspire long-term usage practices.

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