

Fast and Slow: Using Spritz for Academic Study?

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Fast and Slow: Using Spritz for academic study?

1. INTRODUCTION

Students' study habits are characterised by personalized reading skills and strategies that significantly determine academic success (Salmerón Vidal-Abarca Martínez Manà Gil & Naumann 2015; Britt Rouet & Durik 2017). In Higher Education (HE) most students use traditional paper interfaces when studying (Vincent 2016). There is evidence to suggest that digital materials are extremely important resources for students (Margaryan, Littlejohn & Vojt 2011; Parkes, Stein & Reading, 2015), however, affordances associated with the use of paper "have special qualities that cannot be matched by digital media" (Vincent 2016: 104).

In a study analyzing the technological skills of occupational therapy students (Hills Ryan Levett-Jones Warren-Forward & Lapkin 2016) conclude that though electronic devices are invariably shaping how students' access and consume information, the technical ability of students is varied. Bennett, Maton, & Kervin (2008) contend that though many "net generation" (born post 1980) are familiar with digital and internet technologies) and may have become adept at using digital technology they are not necessarily "digitally native". Kennedy & Judd (2011) explain that many of the net generation students are good at the technologies they find relevant and use consistently but considerably inept at a whole range of technologies that may be used for educational purposes. Margaryan, Littlejohn & Vojt, (2011) suggest that students' expertise with digital devices far exceeds many of their lecturers in social and informal settings; by contrast their ability to take advantage of the affordances of the equipment for academic purposes is considerably diminished by "narrow expectations of learning in higher education" (Pg. 439).

Furthermore, as more technologies become available, students seem to be comfortable using the technology they are required to use (Jones & Healing 2010) and not particularly keen to adapt innovative software or devices for academic study. Students now routinely use personal phones and tablets as reading devices (Bennett Maton & Kervin 2008; Di Nocera Ricciardi & Juola 2018). The ubiquity of these devices and the likelihood that even smaller gadgets like Smart Personal Objects (digital watches, wearables, etc.) will steadily also become more user-friendly

reading devices demonstrates that reading habits will be altered as technology evolves (Benedetto Carbone Pedrotti Le Fevre Amel Bey & Baccino 2015). The advantages of digital reading technologies are numerous, including improved legibility of text, storage capacity and portability (Di Nocera Ricciardi & Juola 2018; Larson, 2010). The availability of these types of devices and innovative applications have created an opportunity for digital reading technologies to replace paper (Schneps Thomson Chen Sonnert & Pomplun 2013).

Digital material – e books, electronic journals, interactive PDFs etc. do not seem adequate for academic study (Anderson & Pham 2013) many students feel the devices do not adequately meet their reading needs (Tanner 2014). This paper presents findings from an exploratory study, which focussed on evaluating the technological acceptance of reading technologies and the feasibility of adapting a specific reading tool “Spritz” for academic study in HE. The research team are staff at a modern University in the United Kingdom responsible for developing electronic resources for teaching and learning¹. The paper is divided into six sections; the next section discusses the background and framework for the study. It is followed by a methodology section. Section 4 presents the results and findings, followed by discussion and conclusion segments.

2. BACKGROUND

In HE the way technology is used is evolving. Assistive technologies were used to support students with impairments (Goldrick, Stevns and Christensen 2014) however, increasing technology is used to enhance learning activities. Lecturers are now using e-learning resources to engage students in the classroom. They also suggest students use learning technologies for independent study and University librarians and support tutors in the academe also provide digital contents for students to use – videos, voice recognition software, mind maps, hypertexts, applications for reading, etc. are being designed in online formats. Journals are also publishing online versions and e books are readily accessible with additional features which enable students to share annotated materials in real time thereby supporting

¹ The project was sponsored by the University’s Disruptive Media Learning Lab and supported by a senior lecturer - Module Leader, English for scientific purposes

study activities (Van Laer & Elen 2018; Vincent 2016). Students are free to study anywhere and at any time with other students synchronously or asynchronously.

There is a distinct paucity of studies examining how technologies are adopted by students (Cheung & Vogel 2013) at a time when technology is being integrated into education so quickly. It is important to understand exactly how effective the resources are and how they can be adapted to promote learning (Van Laer & Elen 2018). RSVP has mainly been used to promote speed-reading, however, evaluating students' needs alongside the technology uncovers various other ways of using tools like Spritz to enhance students study activities. Speed is not always relevant for students' text consumption needs; comprehension, is more important; measured as the ability to recall information previously presented (Rayner et al. 2016) comprehension and speed may be negatively correlated.

Salmerón et al. (2015) argue that reading comprehension is significantly influenced by the readers' goals, the relevance of the content and context of the settings. As such readers may be selectively choose materials they need to comprehend when studying; students' study habits therefore include varying reading speed and concentration relative to perceived tasks (List Grossnickle & Alexander 2016; Rouet Britt & Durik 2017). It is important to account for the myriad of features that influence readers' goals during independent academic study. These include both contextual dimensions and independent processes that prompt readers to adapt their reading: such as:

1. Implicit cues – intention of reader, purpose of activity, motivation;
2. Self-regulated attributes like prior knowledge, skills, language proficiency, as well as self-attribution on account of assumptions and inferences made serendipitous by the reading task
3. Extraneous resources – support provided, tools, physical and social context from a request (including the authority of the requester (lecturer/or friend and the presumed relationship with the same).

These constructs govern reading which is both a social and cognitive process (Britt, Rouet & Durik 2017) and therefore dependent on the agency of the reader, particularly when using novice

resources like Spritz. Students can choose to adapt their reading styles if they envisage the resource will support them by saving time or improve efficiency.

Student study behaviours revolve around reading; however, there are few opportunities to assess the appropriateness of technologies suitable for independent study activities in HE. The developers of Spritz, a rapid reading technology recently gaining popularity for its efficiency in non-academic settings (Ricciardi & Di Nocera 2015) claim it is efficient and suitable for text consumption at rapid speeds. Citing internal partner research studies in association with Metametrics, Cengage Learning and an ERASMUS Study led by the National College of Ireland's Michael Goldrick (yet to be published), Spritz (2015) suggested that students liked the Spritz experience because it helped them focus on a piece of text with little or no loss in comprehension.

Independent research has shown that Spritz users experience considerably lower literal comprehension (Di Nocera, Ricciardi and Juola 2018; Benedetto et al. 2015). The studies commissioned by Spritz also seemed to ignore the visual challenges associated with digital reading, for example ocular overload. Benedetto et al. (2015) tested inferential reading levels using two modes – paper and Spritz; assessing comprehension, visual fatigue, performance, task load, and ocular behavior. They study concluded that Spritz negatively impacts all variables except inferential comprehension, which was comparable for both paper and spritz users at “normal reading speeds of around 250 words a minute. The Benedetto study used a relatively complex piece of text from George Orwell's “1984” for the evaluation, in contrast to the short simple text used by the Spritz evaluators.

Studies have shown that the Rapid Serial Visual Presentation (RSVP) technology used to develop Spritz, supports reading for some people with visual impairment (Schneps Chen Pomplun Wang, Crosby & Kent 2019); for readers with low vision (inability to read at normal reading distances of 40cm even with corrective lenses) Spritz effectively improves comprehension by up to 50 - 200%. The studies explore the performance of Spritz using quantitative methods to make generalized comments.

2.1 Using Speed Reading Technology

RSVP has been used as an alternative means of presenting textual information for over 50 years. Gilbert (1959) proposed attention could be focused by minimizing eye movements. RSVP has since developed to involve the careful display of text in sizes and segmentation units. Spritz™ has developed the RSVP into an App. Spritz is essentially a speed-reading tool according to its developers. It utilises RSVP to display a single word on a screen in a format that is expected to support the quick recognition of words by triggering word identification using a visual indicator. Spritz optimises this approach by highlighting the Optimal Recognition Position (ORP) of a word within a display, which the developers call a reddicle. This appears in red, filling the readers' foveal vision, which is the main focal point of the eyes (Spritz website) as shown in Figure 1.1. To achieve this, the character count is limited to 13 words per display. Words that are longer than 13 characters are broken up and displayed in two or more segments. RSVP is designed to avoid eye movements as naturally, a reader's eyes dart around the page looking for the ORP.

Figure 1.2 depicts how the words could appear on a mobile screen. With the eyes focused on one location, the reader can concentrate on speed and inferential comprehension (Benedetto et al. 2015, Pg. 356), albeit resulting in increased visual fatigue. Rayner (2009) argues that a reader's ability to decode a word is enhanced not only by comprehension but also by recognition, this is why it is possible to read words that are jumbled (Schotter Tran & Rayner 2014). The ORP supports a reader's proficiency to decode by highlighting the letter that is needed to recognise the word. Though recognition is aided by previous encoding proficiency, the repertoire of long-term memory and the way in which text is displayed (Ricciardi & Di Nocera 2015).

INSERT FIGURE 1.1 (COLOUR)

INSERT FIGURE 1.2

2. 2. Digital Reading Technologies Usability and Functionality

Digital reading technologies have immense usability, the tools and techniques afforded to a user in terms of connectivity to the internet alone could be immense. However, speed-reading technology like Spritz have inherent design challenges which seem to denigrate the quality of reading and also fail to account for features which improve usability for independent learners (Rockinson-Szapkiw Courduff Carter & Bennett 2013). When used in presenting engineering instructions for specialists (Leman Griffin Pegrum Leggoe Titley & Thomson 2015) highlight how Spritz significantly reduced the rate of comprehension. Other scholars, (Jabr, 2013; Chien Chen & Wei, 2008; Chou, 2011, Benedetto et al. 2015) question the usability of these technologies, citing problems associated with eye strain, visual fatigue, cognitive blindness and the poor reading habits of so-called digital natives. However, transitions in communication media have similarly been met with skepticism (Schneps et al 2013). Computers were once deemed clunky and impractical for reading (Kay & Luuricella, 2011) due to the poor quality of the display and glare; nevertheless, improvements and adaptations have improved usability and acceptance. The trajectory of such developments in reading technologies have resulted in new reading habits particularly in relation to collaboration, organisation and efficiency.

About a decade ago, digital reading was deemed impractical (Thayer Lee Hwang Sales Sen & Dalal 2011) problems included tiresome navigation and poor legibility associated with small screen size, poor quality and limited adaptability. In the last decade, many of these design flaws are being rectified by improved technology that allows readers to annotate, use improved navigation and search features. The devices also have improved ergonomic features. Though some efficiencies associated traditional paper cannot be easily replicated. For example, cognitive mapping Chou (2011), which allows the reader to build a virtual representation or cognitive map of the reading material. This is difficult to achieve on a small screen and undermines comprehension according to Benedetto et al. (2015); as fixation compromises the ability of the reader to utilize a “broad range of pre- and post-foveal processing” (pg. 355). Rayner et al. (2016) demonstrate how RSVP distorts the natural reading process by undermining opportunities to decode information using headings, diagrams and other visual or textural cues that are cleverly used as landmarks for navigation and recollection. Li Chen & Yang (2013) refer to these reading

habits as cohesion cues that enable a reader to process texts in chunks with a view to aiding shifting.

2.3 Cognitive requirements for reading

University-level study involves understanding content for essay writing, exams or comprehension concepts that will support the reader's mastery of skills and techniques of her profession. Such reading is cognitively demanding, time consuming and often perceived as burdensome (Salmerón et al.2015). Thayer et al. (2011) characterised five reading techniques identified by Pugh (1978) that students use for academic purposes on the basis of the cognitive processes students engage with while studying (see Table 1).

Table 1: Reading techniques in relation to cognitive engagement and level of comprehension. Adapted from Thayer Lee., Hwang Sales Sen, & Dalal, (2011).

INSERT TABLE 1

Table 1 shows the different reading skills students are encouraged to utilize when studying; the first three rows scanning, searching and skimming are considered low intensive reading activities. Hinrichsen & Coombs (2013) argue that scanning activities do not require deep or active reading; especially for high order critical, evaluative comprehension. Chifari Chiazzese Seta Merlo Ottaviano & Allegra (2010) counter this argument suggesting that digital reading actually requires more strategic cognition or metacognition dimensions which are inherently part of a complex set of reading schema determined by technological, pedagogical, content and user components (pg. 492). As such technical features like: the presentation of the text, multimediality, linearity, etc., as well as the idiosyncratic features of the reader: proficiency, motivation, planning, skills and processing capability determine herself comprehension levels.

In addition, students rely on intense, deep reading and critical engagement when they are making meaning of academic text (Chifari et al.2010). Rows 4 and 5 of Table 1 describe the level of intensity needed for receptive and responsive reading. To engage with this level of concentration, students tend to annotate, highlight, compare, etc. using personalised reading practices they have developed over time to dynamically navigate specific texts.

Digital reading technologies like Spritz are readily associated with scanning, skimming and search reading (Schneps et al. 2013). Chifari et al. (2010) discuss how students' use cognitive scaffolding to support digital reading, the process involves dynamic techniques which evolve as readers engage with varied levels of complexity. Readers will develop individual mental strategies for first evaluating comprehension and secondly determine whether a text is useful. The complexity apparently involved in digital reading, even simple encoding while scanning and skimming explains why Baron (2015) found that students are more likely to read printed books when studying. In addition, net generation students prefer to read printed material because the electronic devices inherently incorporate non-academic activities such as the use of social media and pastimes that distract attention (Rose 2011). Larson (2010) argues that students typically use print when engaging in meaningful academic reading.

Reading with Spritz was perceived to be more demanding under challenging circumstances such as unfamiliarity with the text and long pieces, (Benedetto et al. 2015). RSVP supports aging readers (Schneps et al. 2019) although it has been shown to be particularly uncomfortable, it is also demonstrably more efficient than traditional reading when considering reading rates. Ricciardi & Di Nocera's (2015) study showed that participants reading rates were meaningless if they could not understand the words, this study also challenged the notion that Spritz comprehension was efficient because the technique increased visual fatigue. Ricciardi & Di Nocera (2015) show that their participants had difficulty encoding words, particularly, when Spritz reading levels exceeded the normal, traditional speed of 250 words a minute.

Studies (Benedetto et al. 2015; Rayner et al. 2016) show that Spritz' benefits certain user profiles, its efficacy is demonstrable linked to the reader proficiency, particularly the mastery of the subject, their familiarity with the content and the linguistic complexity of the text. In addition, Spritz appears to have benefits for people who want to skim or scan texts, not intending to achieve complex inference.

Ricciardi & Di Nocera's 2015 study had shown that adjusting Spritz speed to normal (250 words) rates enabled participants to comprehend as effectively as traditional readers. They called for

studies which explored the differences in participants reading capability, their level of engagement and the use of short texts. The hypotheses for this project were based on the acceptance of the technology for study and sought to explore how students' behaviours and habits were aligned to using Spritz for independent study. Project hypotheses were based on reader proficiency:

1. User acceptance levels for English First Language (EFL) Students will be significantly higher their English Second Language (ESL) counterparts because of their familiarity with the language
2. Both EFL and ESL will report higher perceived efficiency of Spritz with respect to short, simple reading tasks than complex and scientific material.
3. Both groups will have lower perceived usefulness with respect to the more scientific academic reading tasks.

A sample of net generation students in HE were targeted, the literature indicates that there is limited research outside of primary school settings where students have limited vocabulary (Rayner Schotter Masson Potter & Treiman 2016). The sample includes proficient readers at HE level both native English speakers and "learners" of the language. Prior studies also suggest motivation to read is a significant feature of the effectiveness of Spritz (Ricciardi & Di Nocera 2015). The sample focused on students enrolled on a study skills module - English for scientific writing, indicating the students are motivated to improve their reading. The lessons introduced reading habits and support strategies for writing/studying in the sciences. We sampled volunteers from two classes of thirty. The study highlights the usability of optimised RSVP for study purposes and explored its limitations, the functionality of the resource for certain reading tasks and the limitations of optimised RSVP speed-reading in academic study.

This study uses a qualitative method to collate insights around usability and effectiveness for academic study in relation to Spritz, using an adapted Technology Acceptance Models (Cheng & Vogel 2013; Abdullah & Ward 2016). Previous studies have used qualitative approaches to interrogate major correlations amongst users. Qualitative analysis enabled in-depth examination of perceived motivations of the reader based on their proficiency and personalised study habits. The technology acceptance model suitably investigates perceived usefulness, perceived ease of use,

attitude towards use, performance expectancy, motivation of user, social influence and behavioural intention (Abdullah & Ward 2016), the adaptation extends the evaluation to collate insights around perceived adaptations which would make the technology more relevant and increase usability. In addition to investigating how students could use Spritz to complement their study habits, the adaptation allowed researchers to consider how the tool could be adapted as an e-resource for students seeking to expand their personalised study strategies.

3. METHODS AND MATERIALS

An adapted TAM approach was used to evaluate the Spritz tool acceptability for academic independent study and interrogate potential adaptations for different user profiles (Abdullah & Ward 2016). To achieve this, the research team set up specific conditions to account for a number of the features which influence the efficacy of a digital reading process. Accordingly, purposive sampling was used to engage the target groups. First of all, the participants were students who had expressed an intrinsic level of engagement and motivation to improve their reading skills by enrolling on a module - English for scientific writing. Furthermore, the group was split into two sets: students for whom English is a First Language (EFL) or “native speakers” and those for whom English is a second Language (ESL). This allowed for a comparison amongst users who have a good grasp of the orthography, semiotics and morphosyntax of the texts with those who do not.

To assess comprehension, researchers measure the capacity to recall information which has been previously presented (Rayner et al. 2016). Three different layers of comprehension are identified by Basaraba Yovanoff Alonzo & Tindal (2013), namely: literal, inferential, and evaluative. Literal comprehension relates to explicit recollection, very specifically stating what the text states. However, inferential comprehension measures readers’ capacity to make deductions based implicit references not directly stated in the text. Finally, comprehension that measures evaluative capacity envisages that readers not only understand the text but also critical analyse what they infer from the text to other pieces of information (Benedetto et al. 2015).

Two essential processes aid comprehension, according to the Gough and Tunmer model elaborated by Brinchmann, Hjetland & Lyster (2015). Firstly, a person should be able to decode information by word recognition “using rules of letter-sound” (pg. 1). On the other hand, evaluative comprehension involves interpreting sentences (Perfetti 2007) using an individual’s lexical information bank to assess meaning. Processes are complex and it is difficult to account for all variables which make recollection, deduction and evaluation possible – including the physical and social cues like prior knowledge, motivation of the reader and the type of instruction provided which invariably influence reading comprehension. The design of the project focused on the participants’ self-reported personal goals and agency. The team focussed on providing students with a comfortable study space and material relevant to their reading behaviour and habits. Students were informed of the purpose and aims of the project in line with ethical requirements. Ethical approval was granted by the University Ethics Committee.

3.1 Sampling

Purposive sampling was used to identify a suitable student population registered on an English for scientific writing module. 55 students were introduced to the project; nine participants volunteered to take part in the three-week pilot study. Four from the first group (EFL) and five from the second (ESL). There were seven female and two male participants, first and second year Biological Science students with an age range from 19 - 20. Only one student had heard of Spritz before the study.

3.2 Equipment

Students took part in the individual reading task using standard desktop workstations situated in a general student IT room and the Spritzlet plug-in. Each student could adjust the settings of the computer accordingly. The group task was achieved by projecting the reading material onto a screen.

3.3. Intervention

The multiple case study approach enabled the researchers to collect narratives from participants about their experiences of using the technology and their individual perceptions with respect to perceived

usefulness, efficacy, expected performance and behavioural intention. Spritz is versatile and can be applied in many contexts through the Spritz application programming interfaces (API). Specifically, it could be used to read online texts directly from a website using a browser-based application called Spritzlet. “Spritzlet “Spritzs” any type of compatible web-based text. Potential participants were introduced to the app during an introductory session in the classroom during a half hour session. This consisted of discussing baseline reading strategies taught in the module and asking students to consider how they could use Spritz. The app was presented to all students in the class and according to ethical guidelines only students who voluntarily wanted to participate were invited to be participants. The students completed consent forms after reading the project information sheet.

The initial part of the pilot study was an hour-long introductory, practice and assessment session. All the participants were allowed to familiarise themselves with Spritzlet in a computer lab for 30 minutes. They were then assigned two five-minute reading exercises. One was a scientific piece, a public health journal highlighting the dangers of sugar in human diets (text 1). This was designed to be familiar, non-challenging reading with few scientific or long words. The second was an article summarising the emergence of new technologies (text 2); chosen because it had the kind of long words and scientific material our participants would engage with in their studies. The reading exercises were provided in digital format, text 1, with and without Spritz followed by text 2 with and without Spritz on a large screen. The students were asked to summarise the texts using the techniques they had learned in class in turn. The participants self-assessed their summaries just as they do in class and were asked to reflect on the efficacy of the resource for independent study. Participants were then encouraged to use Spritz as part of their personalised independent study for three weeks, after which they were invited to a structured focus group.

3.4 Data Collection

To review acceptance, usability, efficacy, study behaviours for class/exams/essays and expectancy of reading technologies, students completed two open-ended questionnaires. (1) Pre-intervention one before they used the app and (2) a post-intervention survey three weeks after. Focus groups also took place at the end of the study. The focus group discussions were recorded and transcribed by a university scribe. Two researchers coded the transcripts using the Green Willis Hughes Small Welch

Gibbs & Daly (2007) framework. A four-point coding strategy was used to group the data along the TAM evaluation categories - acceptance, usability, efficiency, performance expectancy, adaptability and study behaviour -preference/strategies. Themes were identified in each of the categories and classified on the basis of the implications for design and engagement as identified in the literature. Subthemes were also identified relating to reading technology efficacy.

In the structured focus group, discussions were between 30- 45 minutes and participants discussed how they had used Spritz over the three weeks. Data was collated for each group - EFL and ESL students during independent sessions. The focus group data was analysed using a Braun & Clarke's (2006) thematic approach.

4. RESULTS

Overall, students found Spritz difficult to use for reading in general and study in particular. With respect to the hypotheses,

1. User acceptance levels for EFL students were only moderately higher than ESL peers. Familiarity with the language only marginally improved their perceptions around ease of use.
2. Only EFL students found Spritz efficient for studying short texts. ESL users perceived efficiency was low for both simple and complex material. ESL users indicated an openness to try upgraded versions of Spritz.
3. Perceived usefulness was markedly low with respect to scientific academic tasks. Usability and performance expectancy in relation to skimming or scanning were also low because the resource did not align with users' behaviours. Based on the adapted TAM evaluation the four major themes identified are discussed below – usability/ ease of use, functionality, perceived usefulness, attitudes towards use if adaptation are introduced and behavioural intentions.

4.1 Usability/ease of use

None of the students thought Spritz met their requirements. During the three-week testing period, 50% did not use it at all, others used it for casual reading. The students cited poor usability and efficacy challenges – inability to stop and annotate, use coding cues and poor comprehension. One

ESL student reported acceptance and perceived efficiency for studying material, stating that Spritz supported idiosyncratic reading strategies.

Table 2.1: Key themes from ease of use analysis

INSERT TABLE 2.1

The participants suggested that the key purpose of Spritz is speed-reading; a process they use for shifting and planning during study. However, Spritz does not provide any features to actually sift, bookmark, code or look up unfamiliar words. Spritz was more tedious to use because it required more mental energy and awareness. For EFL students, word recognition or decoding was possible at almost any speed; however, it was significantly uncomfortable at speeds above 350wpm particularly when reading new, complex or technical words. For ESL students, decoding was almost impossible even at normal reading speed.

Table 2.1 demonstrates the overwhelming dissatisfaction with respect to ease of use. Most of the students reported during the pilot exercise that they had to stop the app regularly to read long words, or were completely lost when they did not understand certain words. Spritz lacks navigational functionality and this significantly made the resource difficult to use. In addition, this resulted in visual fatigue, cognitive blindness and inattention blindness. EFL students recognised long words even when Spritz split the word for optimal reading but the process disrupted their normal reading patterns. In contrast, ESL students reported that complex words interrupted their reading altogether.

One student said he had practiced how to use Spritz and found it exceptionally useful for quick revision, especially for things that he did not really want to read because it helped him focus on the task. In general, the participants were happy to use Spritz for casual reading but not study. It fragmented the reading process, was robotic and felt tedious. Some said it made the reading experience boring. The advantage of focused reading was outweighed by the tediousness of the exercise. Some participants opined that Spritz might better suited on small devices. See table 2.2.

Table 2.2: Key themes linked to efficiency/performance expectancy

INSERT TABLE 2.2

4.2 Perceived usefulness/ functionality

The Spritzlet app does not have the functionality the students needed for study. Spritzlet does not include functions that allow for mental marking, cognitive recognition, pagination or cohesion prompting. Table 2.3 shows the themes linked to the perceived usefulness of the tool.

Table 2.3: Key themes linked to perceived usefulness

INSERT TABLE 2.3

Students develop kinesthetic cues such as folding, highlighting, annotating and doodling on paper texts, features not available in Spritz. There are no distinctions between headings, subtexts, footnotes, etc. The end of a paragraph is indicated by a slightly longer pause between words, but not considered particularly useful by the students during both the pilot study and independent reading.

Students' academic study requires a substantive amount of fact checking, referencing and reflection, the Spritz landscape does not accommodate these needs. Most participants noted they did more than one thing during their study time, including listening to music, doodling, or doing household chores and such multitasking is not possible with Spritz.

4.3 Attitudes towards use if adaptations are implemented – personalization, gamification

Both focus groups discussed possible adaptations to make Spritz more appealing to the academic reader.

Table 2.4: Key themes linked to attitudes towards use based on adaptations

INSERT Table 2.4

The participants highlighted how the RSVP technique could be harnessed for enhancing various aspects of the mechanics of reading and studying. The adaptations they suggested are often used in other digital tools, like the interactive PDF and new voice recognition assistive technologies used to annotate, share with others in real time and code reflections.

4.4 Behavioral Intention

The participants pointed out that the challenges of using Spritz were mainly related to the need to alter their study practices, perhaps Spritz could be used with young people who are more amenable to changing their study practices and reading environments. Some students suggested younger generations were more digitally competent.

The technology initially seen as exciting and innovative, but the novelty quickly wore off because the tool was not easy to use and did not align with students' study practices. Only one student expressed the intention to use Spritz regularly.

5. DISCUSSION AND IMPLICATIONS FOR DESIGN

Some scholars (Britt Rouet & Durik 2017; Schotter Tran & Rayner 2014) argue that the mechanics of studying are complicated by the digitisation of texts. This underpins Spritz perceived unsuitable for academic study, the students preferred mediums with which they were familiar and did not want to adapt personalised strategies. Sage Krebs & Grove (2018) suggest that because paper is readily embraced as the medium of study, digital texts are undervalued. Ricciardi & Di Nocera's (2015) have demonstrated that Spritz can create excessive mental overload disrupting cognitive processes and therefore poor comprehension for many users. Benedetto et al. (2015) also highlight problems with visual fatigue may be remedied by using Spritz for short text with familiar content, though this does not seem ease challenges for users who have poor grasp of the language. This study demonstrates that language proficiency and minimal task load are significant predictors for accepting the Spritz technology. The participants' stated how useful Spritz is when they need to stay on task for short

periods and when the sentences are simple and easily recognised/encoded (Salmerón et al. 2015) however Spritz use becomes uncomfortable and less efficient over time.

Spritz acceptance levels in this evaluation were remarkably low. The most salient features that indicate students' acceptance are linked to personalised study habits – editing texts, taking notes, sharing content for collaboration, bookmarking, cross-referencing, etc. highlighting hop social contexts shape human approaches to reading behaviours. The students study strategies and habits require tools that a user to pause, adapt, share, cross reference, reflect and read multiple texts simultaneously. Vincent (2016) argues that study habits are still geared towards paper, therefore speed-reading using RSVP is not suitable for most student users.

Benedetto et al. (2015) show how the fundamental mechanics of the reading process are not supported by the Spritz technology, correlating findings from other studies that show that visual fatigue and cognitive blindness make Spritz ineffective (Rayner et al. 2016, Nocera Ricciardi & Juola 2018). Thayer et al. (2011) note that reading involves “unconsciously noting the physical location of information within a text and its spatial relationship to location in the text as a whole” (Page 2921). This cognitive mapping is a useful tool (Li Chen & Yang, 2013) for recalling and reusing information. Furthermore, the process of decoding and inferential and evaluative comprehension processes is often personalized (Rayner et al. 2016) when students are studying; slow readers make more regressions and longer fixations and shorter saccades (Schotter Tran & Rayner 2014). This means the ORP for different user profiles varies, indicating how tailored the reading process is for an individual reader (Britt, Rouet & Durik 2017).

Furthermore, net generation students have become accustomed to instantly sharing reading material and cross-referencing using the internet when studying (Hills et al. 2016). Though Spritz recognises the electronic environment and takes advantage of the internet to reach its users, it does not include enough features to enhance academic collaboration, organisation or efficiency. The reading process is also aided by drawing upon prior knowledge and experiences (Britt, Rouet & Durik 2017), consequently, only confident EFL readers find Spritz easy to use. Spritz focuses on speed, failing to harness adequately the modern tools of ICT - text to speech, colour, graphic design, etc.; Spritzlet

inadvertently makes studying a cumbersome and boring activity (Jabr 2013; Vincent 2016; Benedetto 2015).

Improvements in technology have invariably influenced study practices, however, various studies (Rayner et al. 2016; Hills et al. 2016; Schneps et al. 2019) show regardless of perceived usefulness some people struggle to adapt new technology. Students are less prepared to modify their study practices to accept technologies like Spritz because associated benefits are negligible (Vincent 2016; List Grossnickle & Alexander 2016). Furthermore research (Margaryan, Littlejohn & Vojt 2011; Kennedy & Judd (2011) shows the skills of students with respect to the use of new technology is actually limited in the academic sphere. Only a handful of students were willing to explore using a new tool for study, the majority were not looking for technological solutions.

Students indicated that they will be amenable to technology like Spritz if they were required to access text on smart watches or micro- displays that conform readily to single word reading. They also wanted Spritz to accommodate their personalised online behaviours such as the use of voice annotation, videos, and hypertexts. Students required devices that were suitable for both academic and social experiences. Rockinson-Szapkiw Courduff Carter & Bennett (2013) suggests more work is needed to examine the usefulness of new technologies for particular reading activities, as the devices may become outdated (Vincent 2016) before the required pedagogies are developed for use in academia. Investing in personalised reading devices for students will be challenging if the tools change so quickly. Research is needed to understand what the tangible needs of students are in relation to reading technologies to avoid unnecessary costs associated with developing single-use technologies.

The study demonstrates that ESL students may find Spritz more challenging, though practice seems to enhance a student's capacity to use the tool efficiently. The tool is suitable for reading short, simple material only because it keeps participants focused on task (List Grossnickle & Alexander 2016). However, when studying students prefer to be able to comprehend and staying focused on a piece of text does not always support comprehension. Spritz could be adapted to support ranges of cognitive load rather than focusing on speed, especially for slow readers or students with visual or neurological impairments.

Though students originally found Spritz to be innovative and exciting, this emotion quickly wore off for many of the students because using Spritz required a significant change in their study habits and patterns. Spritz may be more beneficial as a digital add-on tool, offering an alternative reading method that allows for manipulation of text size like e-readers. If it is gamified the psychological needs of students could be met with innovative approaches to the reading process – including rewards, challenges, levels, experience points, mastery, badges etc. which personalize the experience for different user profiles, allowing them to enjoy the experience of studying in distinct and stimulating ways. Some e-reader developers have incorporated Spritz into their applications and there is scope for the technology to work within immersive technologies such as augmented and virtual reality. Voice commands, hand gestures and eye-gaze all offer solutions to improve interaction with Spritz and other emergent technology. Further study into these arenas is necessary provide insights into how students will adapt technological changes and how they could be used efficiently within academia.

Reading has evolved through a number of social contexts which deconstruct literate behaviours (Rayner et al. 2016). Study practices will continue to be influenced by new forms of literacy, shaping functionality as pedagogical processes change and reading patterns as new devices or software become available. In its present form Spritz offers speed, it could incorporate the essential modifications to enhance usability and functionality of RSVP; allowing for social and collaborative engagement and remove the barriers that inhibits contextual understating and decoding of the text for different user types.

5.1 Limitations of the study

This study was an exploratory study and only recruited a small number of voluntary participants. The number of students involved did not permit quantitative data analysis. Secondly, it is difficult to account for all the variables that support digital reading processes in a classroom setting. The research team could not replicate the research carried out by Spritz TM; their internal studies have not been peer reviewed and seem to be in partnership with companies that sell speed-reading methods. This limits the capacity of researchers to understand the user profiles Spritz is designed for.

The research also focused on the effects of varying the level of difficulty of the text, the nature of the content and reader proficiency to evaluate the degree to which personalised reading strategies influence user acceptance. More research is needed to understand how Spritz supports users who use it comfortably; particularly with respect to the type of visual mechanics and social cues that enable easy encoding and comprehension. The research team is also keen to examine how personalised features such as gamifying the tool or including annotating/coding functionality improves user acceptance. Larger cohorts of students are required to make generalisations for sizeable user populations.

6. CONCLUSION

Digital reading technologies have the potential to support or even redefine student study practices, though studies find that students' behaviours are hardly changing. The findings from this study suggests students do not want to alter their existing habits and personalised strategies if they do not envisage substantial benefits that allow them to not just read but also modify the text, sift, categorise and share text collaboratively. This demonstrates that when designing new technologies for academia it is important to align with users preferred behaviours, particular online engagement. Net generation students in particular seem to respond to adaptations that mirror their activities in other online environments and accept technologies that enable them to control or personalize the interface, document the efficacy of using the resource (collate rewards) and collaborate with peers in real time. With respect to academic study, the findings suggest that Spritz has at least limited potential as an academic study tool. It supports sifting and enhances skim and scan reading for readers comfortable with the text. It is essentially a speed-reading tool, but will need to be substantially adapted to support study habits and behaviours used by today's students.

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