Int. j. inf. tecnol. (March 2017) 9(1):77–86
DOI 10.1007/s41870-017-0012-0

ORIGINAL RESEARCH

# Effects of personality traits and preferences on M-learning

**Mazen Al-Ismail**[1] · **Tom Gedeon**[1] · **Mohammad Yamin**[1]

Published online: 23 February 2017


**Abstract** The revolution in mobile devices and wireless networks has transferred E-learning to mobile learning (M-learning). Delivering learning materials (podcasting) to mobile learners is a challenging task due to the variability of mobile learner contexts. This paper presents a novel method of considering mobile learners' preferences of podcast types in different contexts, utilizing learning preferences and personality. The survey has been collected from 345 students from Australia and Saudi Arabia. Unlike previous studies, this paper deals with all podcast types. Two dimensions have been included in context namely: physical space and social space. This has been followed by determining big five personality traits and learning preferences to determine how to personalize mobile learners' podcast usage preferences.

**Keywords** Learning preferences · Personality traits · Mobile learning · M-learning preferences · Podcast preference · M-learning context

## 1 Introduction

Rapid development of wireless networks and mobile devices has facilitated remote access. Mobile devices like Smartphones and tablets have changed the people's perception and ways of connectivity. According to the International Telecommunication Union (ITU) the number of mobile broadband subscribers is around 3.2 billion for 2015 [1]. This revolution has transformed E-Learning to M-learning.

M-learning is "e-learning through mobile computational devices: Palms, Windows CE machines, even your digital cell phone" [2]. M-learning has been classified as a new era of digital learning [3]. However, M-learning cannot be directly compared with traditional E-learning as M-learning is extremely dynamic and should to target a user's current context and his/her learning requirements [4]. This feature empowers M-learning to overcome the limitations of learning spaces and time. Thus, learning materials (e.g. reading, podcasts) could be delivered anytime and anywhere for mobile learners.

Common learning materials which could be delivered to M-learning are text (e.g. E-books, PDF), audio, and video (podcasting). Podcasting supports the communication between students and lecturers. The current tendency is [5] to define podcasts as "Podcasts are audio, video, text, and other media files that can be played on the computer or downloaded to MP3 player". So [6] characterizes podcast services in terms of usage, publishing and dissemination and conclude podcasts could be video, audio, and mime types which in most cases refer to text such word and pdf.

Delivering the optimal podcast length and its effect on students have been discussed recently [7–9]. Although researches on last decade emphasize to have short length of podcast [10], this decade a number of studies show different views regarding podcast length and how long podcast could affect positively or negatively on students learning. A study has been done by [7] where they have investigated the differences of value and preference between long podcast and short podcast in educational context. Long podcasts are full lecture records, while short podcasts are 3–5 min' summary lectures. The study shows that the number of short podcasts downloaded is much

✉ Mohammad Yamin
doctoryamin@gmail.com

[1] Research School of Computer Science, Australian National University, Canberra, Australia

higher as compared to long podcast. However, students have rated a number questions regarding short and long podcast, in terms of understanding and doing better in the course, both long and short have been rated highly. Also, in terms of recommendation to other students, both long and short were highly recommended to other students. A different study [8], where authors explore the relationship between the usage of video podcast (vodcast) patterns and students' attitude. While usage patterns are level of experience, platform used, watching style, and vodcast duration, while students' attitude are usefulness and intention to use. The result show that students who experience to have vodcast longer than 25 min are significantly more likely to use (intention to use) vodcast again compared to student experienced short vodcast (<25 min). A case study has been done in two engineering courses [9] where authors investigate the influence of podcasting on student learning. With questionnaire open-ended questions followed by in-depth interviews, evidences that long podcast have been used. Students have been used long podcast for a number of reasons such as missing some details on the traditional lecture, listening to podcast like one-to-one situation with lecturer, and it helps non-native English speakers to play full recorded lectures to understand the learning materials. However, none of previous researches investigate mobile learner podcast lengths' preferences in different contexts.

Preferences for podcast type and its value have been discussed on prior studies. A study was done by [11] to facilitate access to vodcast for pre-service teachers. Vodcasts have been designed to explain software skills for pre-service teachers. Some teachers show a preference for face-to-face instructions and playing with the software compared to vodcasting. However, pre-service teachers show an obvious preference for vodcast compared to written instructions. In the other hand, studies confirm that previous experience influence on podcast preferences. For example, Giannakos et al. [8] investigate the effect of podcast experience on students' attitude. The study shows a significant relation between podcast experience and its usefulness. Another study was done by Collier-Reed et al. [9] where they have investigated the influence of podcasting on students learning. The open ended questionnaire and in-depth interviews show that some students prefer notes rather than podcast and the reason was that they never experienced the podcasting. From these studies, indeed, the prior experience of podcast effect on students' preferences. Moreover, last decade demonstrated the value and usefulness of podcast in education, however, only one study has compared students' preferences among major podcast types such as (audio, vodcast, and slides) [12]. The study has been done with two different courses to investigated students' preference among podcast types. Students' preferences are 63% slides, 21% vodcast, and 12% audio podcast, however, when students have been asked which podcast type should be available, more than 60% thought all podcast types should be available. This is not a contradiction, but more researches are indeed needed to explore the students' preferences. Again, none of previous studies have considered the preference of podcast types in different contexts. We claim that our study is the first in the social contexts and physical contexts.

Most studies consider limited or one environment (e.g. field around a school [13], museum [14]) and this is understandable because of the study nature. Moreover, qualitative studies reveal that students enjoy m-learning outdoors and while moving (e.g. on the bus) (2 SOURCES). So, our study stress that the main value of M-learning is mobility [15, 16]. Therefore, our study considers two main concepts which are mobility in physical space and mobility in social space.

Mobility in physical space and social space are one of the fundamentals results of unpacking mobile from mobile learning [17]. Mobility in physical space means that a mobile learner is moving from one place to another and crams learning in the gaps of daily life, while mobility in social space means a mobile learner encounters social events such as being with family members and/or friends. Furthermore, Mobility in physical and social space are overlapping, for example, a mobile learner can be in a busy environment such as a café with a friend. However, to the best of the authors' knowledge, no studies have considered the effect of mobility in physical and social space on mobile learner preferences.

Mobility in social space has a different set of attributes values (CompanionType) based on the study purpose. For example, [18] have included (alone, friend, girlfriend/boyfriend, family, co-workers, and others) as attribute values of companion to assist the recommendation process for watching a movie as an example. Another example, [19] have set companion attribute values as (family member, colleague, boss, and unknown) as social relations between caller and receiver to assist telephony on context aware systems. In this study companion type will be classified as (alone, family, friend, and classmate). On the other hand, the attribute values of mobility in physical space (EnvironmentType) are quiet, busy, and moving environments.

As mentioned above, these environments (quiet, busy, and moving) are overlapping with the notion of mobility in social space. Therefore, this paper investigates the effect of companion type and environment type on mobile learner preferences in two different cultures (Australian and Saudi) (Table 1).

Moreover, this paper investigates the degree to which we could personalize mobile learner preference utilizing VARK, which stands for Visual, Aural, Read/Write, and Kinesthetic. VARK is a reliable and validated questionnaire for learning preferences which was developed by Fleming and Mills [20]. The result of VARK surveys categorize students as Visual, Aural, Read/Write, Kinesthetic,

**Table 1** The big five personality factors *Source*: adapted from [26]

| Trait dimension | Endpoints of the dimensions |
|---|---|
| Emotional stability | Calm versus anxious |
| | Secure versus insecure |
| | Self-satisfied versus self-pitying |
| Extraversion | Sociable versus retiring |
| | Fun-loving versus sober |
| | Affectionate versus reserved |
| Openness | Imaginative versus practical |
| | Preference for variety versus preference for routine |
| | Independent versus conforming |
| Agreeableness | Soft-hearted versus ruthless |
| | Trusting versus suspicious |
| | Helpful versus uncooperative |
| | Disciplined versus impulsive |
| Conscientiousness | Organized versus disorganized |
| | Careful versus careless |
| | Disciplined versus impulsive |

and multimodal learners which can be subdivided into 23 possible combinations [21]. More details of the main VARK categorization are clarified in Table 2.

VARK preferences have been included in smart phone studies. For example, a Dunn and Dunn learning style model has been proposed by [22, 23] as a proper model for M-learning. Also, a mobile learning model has been designed for different learning preferences which are built on the Myers–Briggs category indicator. Another study has been done by [24], and investigates preferences and opinions of business schools students to design an application for mobile marketing education. Moreover, qualitative studies tell more about students' learning style. For example, some students express that they prefer video podcast as they are visual learners [11], while a different study [25] show some students prefer e-book as he or she likes written things and like to see what people write. Consequently, our first research question is:

What is the relationship between VARK learning style and podcast type preferences in different contexts?

On the other hand, this paper has utilized big five personality traits to personalize mobile learners' preferences. As big five provide comprehensive understanding of personality. Big five is widely known for organizing human personality into five factors. In more details, the five factors provide a broad level of personality. The big five factors are: openness, agreeableness, Conscientiousness, Extraversion, and emotional-stability. For more details, each dimension has been explained in Table 1. We believe different personality will affect the time considered for m-learning, especially our model considers different attributes of social space or context which are: (alone, family, friend, and classmate). So our second research question is:

What is the relationship between BIG5 personality types and mobile learner attitude toward podcast in different contexts?

## 2 Method

### 2.1 Subject

The subjects for this part of the research are university students from Australia and Saudi Arabia. A total of 700

**Table 2** VARK learning preferences *Source*: adapted from [21]

| Learning preference | Description |
|---|---|
| Visual | This preference includes the depiction of information in maps, spider diagrams, charts, graphs, flow charts, labelled diagrams, and all the symbolic arrows, circles, hierarchies and other devices that people use to represent what could have been presented in words |
| Aural | This perceptual mode describes a preference for information that is "heard or spoken" |
| Read/Write | This preference is for information displayed as words |
| Kinesthetic | This modality refers to the "perceptual preference related to the use of experience and practice (simulated or real)" |

**Table 3** Results of environment and companion overlapping

| Context | Companion attributes | | | |
|---|---|---|---|---|
| | Alone | Family | Friend | Classmate |
| Quiet | Quiet and alone | N/A | N/A | N/A |
| Busy (e.g. Café) | Being alone in busy context | Being with family in busy context | Being with friend in busy context | Being with classmate in busy context |
| Moving case 1 (e.g. Walking) | Being alone in walking context | Being with family in walking context | Being with friend in walking context | Being with classmate in walking context |
| Moving case 2 (e.g. Vehicle) | N/A | Being with family on car context | Being with friend on car context | Being with classmate on car context |

surveys have been distributed, where 345 responses have been received (126 Australian 219 Saudis) (Tables 3, 4).

### 2.2 M-learning preferences questionnaire

The students' preferences questionnaire has Arabic and English versions as data will be collected from Australian students and Saudi students. The translated Arabic version has been done by the first author, and then it has been edited and validated with linguistic specialist. The questionnaire evaluates the students' preferences of using mobile devices for formal education. Preferences of podcast type (text, audio, video, and slides synced with audio) and podcast length (1–5, 6–15, >15 min) have been structured based on environments (busy context, quiet context, and moving context), and companion (alone, friend, classmate, family member). Please refer to Table 3. Thus, the survey has 12 questions and each question consist of 4 sub-questions, the scale had a high level of internal consistency, as determined by a Cronbach's alpha of 0.963 for Arabic questionnaire and 0.959 for English questionnaire.

### 2.3 VARK questionnaire

VARK consist of 16 questions, each question has four options where participants are allowed to leave it blank, and choose one or more options. In order to have a valid entry, 12 out 16 questions have to be completed. The maximum score is 16 for each set (visual, aural, read/write, and kinesthetic). Permission to use version 7.8 was granted by VARK Learn Limited, Christchurch, New Zealand.

### 2.4 Personality traits questionnaire

Both Australians and Saudis students have completed Big Five Inventory (BFI-44 [26]). The survey consist of 44 items as self-reported which has five point Likert scale to measure big five dimensions. This has been widely used in personality research as it shows superb psychometric properties.

**Table 4** Demographics on Australian and Saudis mobile learners

| | Australians | Saudis |
|---|---|---|
| Gender | | |
| Male | 88 | 143 |
| Female | 38 | 76 |
| Total | 126 | 219 |
| Age | | |
| 18–24 | 97 | 166 |
| 25–34 | 21 | 34 |
| 35–55 | 8 | 19 |
| Marital status | | |
| Single | 109 | 178 |
| Married | 17 | 41 |

### 2.5 Statistical analysis

SPSS version 23 has been used to analyze data. A Spearman's rank-order correlation was run to assess the relationship between preference length of podcast and the score on Big 5 personality traits. We have also assessed the correlation of podcast type and the score of visual, aural, read/write, and kinesthetic (VARK) preferences.

## 3 Results

A Spearman's correlation has been conducted to see the correlation between m-learning preferences in different contexts with big five personality types and VARK preferences for two different cultures, please refer to Tables 5 and 7 for Australian students, and Tables 6 and 8 for Saudi students.

## 4 Discussion

This section will discuss the relationship between VARK and M-learning preferences independently; we will also discuss the relationship between big five and M-learning preferences in a separate section. Finally, we will discuss the advantage of having a combination of VARK and Big 5 for M-learning preferences.

### 4.1 M-learning preferences and VARK

Our expectation is that Visual learners will prefer videos, Aural will like audio and Slides, Read/Write will like text, and kinesthetic will like videos (but less than Visual learners). We also expect that Visual and Aural learners will not like text, Read/Write will not like audio and videos, and Kinesthetic will not like audio.

Most of the results for "Quiet and alone" and "Busy and alone" meet our expectations, except for Saudi Aural learners who liked text. This is possibly due to the busyness natural in Saudi Arabia compared to Australia where (e.g. cafes) are so busy so mobile learner turns to have learning materials with no auditory such as text-based learning material.

For "quiet and alone", both Australian and Saudis with visual preference prefer to have video as learning material. While Saudi with Read/Write preference prefer text-based learning material and kinesthetic learners prefer video, Australian with Read/Write and Kinesthetic show neutral preference towards podcast types.

For "busy and alone" Australian with aural preference liked audio and SLIDES learning materials, however, Saudis as mentioned earlier liked text-based learning material. Moreover, Australian with read/write preference preferred text, while Saudis with read/write preference have neutral correlation towards text. Kinesthetic Saudi learners as expected don't like to have audio as learning material, while Australian show neutral correlation towards audio. Each Australian and Saudis cultures will be discussed in details in the next sections.

#### *4.1.1 The Australian context*

Students with a strong visual preference are more likely to use video learning materials while they are in a quiet context. On the other hand, mobile learners with aural preference are likely to use audio materials and slides synced with audio materials while they are alone in a busy context. They also show a preference for using audio, slides plus audio, and video, which is understandable as being with classmates may require richer podcast types, such as slides plus audio and video, as such a context create a rich study environment of (e.g. sharing IPad or smartphone screen) and dialogs. Students with a read/write preference are more likely to use text-based learning materials than other VARK cohorts while they are alone in a busy context, such as a café. On the other hand, they show a negative correlation for using audio, video, and slides synced with audio while with a friend or friends in a busy and walking context. In contrast, students with a kinesthetic preference show only a negative correlation with podcast types in two contexts: walking with a friend and walking with a classmate. In these contexts, those with a kinesthetic preference find text podcasts to be undesirable. Although these contexts would be unwanted for studying purposes, they show that the kinesthetic group is more unwelcoming of text-based podcasts than other VARK groups (Table 9).

#### *4.1.2 The Saudi Arabian context*

Various aspects of Saudi Arabia are discussed in [27–30]. The Saudi Arabian context also shows that students with visual preferences tend to use video materials for learning in quiet contexts and show a negative correlation of using text-based materials while they are alone in busy contexts. Aurally-inclined students, on the other hand, prefer to use text-based learning materials in the same context, and prefer video-based learning materials while walking alone. Students with a read/write preference prefer to use text-based materials while they are in quiet contexts, and they find it undesirable to use video-based materials while walking with family. Likewise, students with a visual and kinesthetic preference prefer the use of video while they are in quiet contexts and while in a vehicle with family. Audio podcasts are not preferable to be delivered to students with kinesthetic preference while they are alone in busy contexts, as shown in Table 10.

#### *4.1.3 Commonalities or differences between the two cultures*

Mobile learners in both cultures with visual and read/write learning preference show some similarities while being alone. In more details, both Australian and Saudis mobile learners with visual preference prefer video as learning material while being alone in quiet context. In addition, mobile learners with read/write preference prioritize text-based learning material while being alone in quiet and busy context. As soon as they (visual and read/write learning preference) engage with community, different preferences arise due to cultural differences. Although cultural differences effect on m-learning preference and learning preference (VARK), there is no contradiction for all VARK subclasses between the cultures (e.g. having Aural

**Table 5** Correlation for M-learning and big five for Australian context

| | The big five personality factors | | | | |
|---|---|---|---|---|---|
| | Extraversion | Agreeableness | Conscientiousness | Emotional stability | Openness |
| Quiet and alone | | −Podcast** | | | |
| Busy and alone | | | | | |
| Busy with family | | | | | |
| Busy and friend | | | | −Podcast** | |
| Busy with classmate | | | | | |
| Walking alone | | | | | |
| Walking with family | | | | −Podcast* | |
| Walking and friend | | −Podcast* | | −Podcast* | |
| Walking and classmate | | | | | |
| Vehicle with family | | | | | |
| Vehicle with friend | | | | −Podcast** | |
| Vehicle with classmate | | | | | |

* and ** significant for $P < .05$*, and $P < .01$**, respectively. "+" indicate positive correlation and "−" for negative correlation

Australians with positive correlation with video in busy a specific context while Saudis have negative correlation with video in the same context). Moreover, there is no contradiction with each VARK subclass (e.g. students with aural preference have negative correlation with audio as learning material). Accordingly, the relation between VARK subclasses and m-learning preference are affected by cultural differences especially when mobile learner engaged with community, in other word, being in company with family, a friend, or classmate.

## 4.2 M-learning preferences and BIG-5

### *4.2.1 The Australian context*

The Australian population shows different attitudes towards m-learning, depending on personality type; but this section will focus on the *Emotional-Stability* type, as this type has a significant correlation in certain circumstances. As shown in Table 1, mobile learners with a high score in the *Emotional-Stability* type indicate high steadiness under stressful situations, and remain poised, calm, and sensible. Mobile learners with a high score in *Emotional-Stability* tend to have a negative correlation with using m-learning, if they are in the company of family and friends. As shown in Table 5, a significant negative correlation appears with using podcast learning materials, while in company with a friend in a busy situation. Moreover, podcasts are not preferred, either while in the company of others or when moving, for example, while walking or riding in a vehicle.

Figure 1 show the different attitude between high-emotional and low-emotional towards podcast. The figure has been ordered from the extreme similar attitude to the extreme different attitude towards podcast length. A general view to the figure it shows how the gap started between high and low emotional stability preferences in social context except (vehicle with family). This gap increases more in unformal social context. In other word, high-emotional prefer low podcast length while with family and friend compared to low-emotional. The last contexts in Fig. 1 refers to *walking with family, walking with friend, vehicle with friend, busy with family and busy with friend.* We can notice how high versus low emotional-stability have different attitude whither receiving podcast or engaging with family and friends. Especially the last two contexts which are *busy with family and busy with friend* which are convenient place to talk and engage with friends and family for high emotional-stability compared with low emotional-stability.

Consequently, high-emotional far away from m-learning in unformal social context compared with low-emotional mobile learners.

Consequently, Australian mobile learners with a high score of *Emotional-Stability* enjoy their time with family and friends without the distraction of m-learning. This type welcomes m-learning material delivery while they are alone or with a classmate.

### *4.2.2 The Saudi Arabian context*

Significant positive and negative correlations can be seen for m-learning among the so-called big five traits in the Saudi population. However, it is observable that *Agreeableness* has a significant correlation in a number of situations. *Agreeableness*, as shown in Table 1, shows the degree of general concern for social harmony. Mobile

**Table 6** Correlation for M-learning preferences and big five for Saudi context

| | The big five personality factors | | | | |
|---|---|---|---|---|---|
| | Extraversion | Agreeableness | Conscientiousness | Emotional stability | Openness |
| Quiet and alone | | | +Podcast* | +Podcast* | +Podcast* |
| Busy and alone | | | | | |
| Busy with family | | −Podcast** | −Podcast* | | |
| Busy and friend | | | | | |
| Busy with classmate | | | | | |
| Walking alone | | | | | |
| Walking with family | | −Podcast** | | | |
| Walking and friend | | −Podcast** | −Podcast* | | |
| Walking and classmate | | −Podcast** | | | |
| Vehicle with family | | | | | |
| Vehicle with friend | | −Podcast** | | | |
| Vehicle with classmate | | −Podcast** | | | |

* and ** significant for $P < .05$*, and $P < .01$**, respectively. "+" indicate positive correlation and "−" for negative correlation

learners with a high score in *Agreeableness* are helpful, promote compromise to make peace, and are empathetic.

Mobile learners with a high score in *Agreeableness* have a negative correlation with using m-learning when they are in the company of family, friends, or a classmate. As shown in Table 6, a significant negative correlation appears with using podcast while with family members in a busy context, such as a cafe. In moving context (walking), this type prefers no or low podcasting while they are with friends, classmate, and family. While in a vehicle, mobile learners with a high *Agreeableness* score do not want to receive m-learning materials while friends or classmates are around.

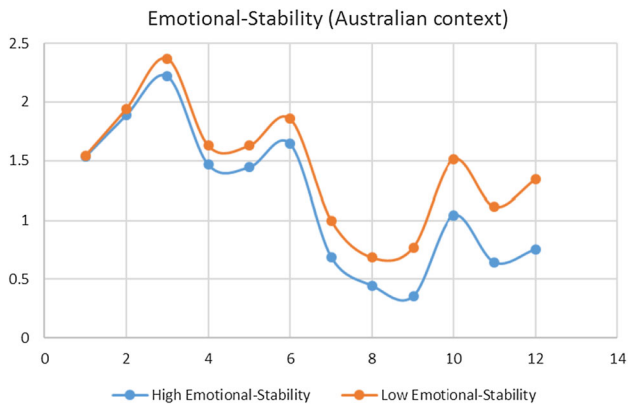


**Fig. 1** Australian mobile learners with high and low emotional-stability scores. The 12 contexts have been ordered as (1) vehicle with family, (2) busy and alone, (3) quiet and alone, (4) vehicle with a classmate, (5) walking alone, (6) busy with a classmate, (7) walking with a classmate, (8) walking with family, (9) walking with friend, (10) vehicle with friend, (11): busy with family, (12) busy with friend

Figure 2 show the differences between high and low agreeableness preferences towards m-learning podcast. The context in Fig. 2 has been ordered from the extreme similar preference average to the extreme dissimilar preference. Similar to Australian with high-emotional, Saudi high-agreeableness show low preference towards podcast in social context. Back to Fig. 2, the gap of podcast preference between high and low agreeableness increases while being socialised. The similarity appears while being alone such as quiet and alone, busy and alone, walking alone and also while being with a classmate in busy context. On the other hand, all formal and unformal context except (busy with classmate) show unlike preference between high and low agreeableness. More specifically, high-agreeableness show less preference towards podcast compared with low-agreeableness.

In conclusion, Saudi mobile learners with a high score of *Agreeableness* tend to value having friendly and warm meetings, even with more formal company such as classmates. This type welcomes m-learning materials to be delivered only while they are alone.

#### 4.2.3 *Commonalities between high emotional-stability and high agreeableness types*

Although *Emotional-Stability and Agreeableness* types both enjoy time while in the company of others, we cannot conclude that they are not utilizing their time study compared with other traits. In fact, both types show a strong positive correlation with *Conscientiousness* (refer Table 11). Mobile learners with high scores in *Conscientiousness* are very organized, conscientious and

**Table 7** Correlation for M-learning preferences and VARK for Australian context

| Context/VARK | VARK subclasses | | | |
|---|---|---|---|---|
| | Visual | Aural | Rd/W | Kinesthetic |
| Quiet and alone | +Video* | | | |
| Busy and alone | | +Audio* | +Text* | |
| | | +SLIDES* | | |
| Busy with family | | | | |
| Busy and friend | | | −Audio* | |
| Busy with classmate | | +Audio** | | |
| | | +SLIDES* | | |
| | | +Video* | | |
| Walking alone | | | | |
| Walking with family | | | | |
| Walking and friend | | | −SLIDES* | −Text* |
| | | | −Video* | |
| Walking and classmate | | | | −Text* |
| Vehicle with family | | | | |
| Vehicle with friend | | | | |
| Vehicle with classmate | | | | |

* and ** significant for $P < .05$*, and $P < .01$**, respectively. "+" indicate positive correlation and "−" for negative correlation

**Table 8** Correlation for M-learning preferences and VARK for Saudi context

| Context/VARK | VARK subclasses | | | |
|---|---|---|---|---|
| | Visual | Aural | Rd/W | Kinesthetic |
| Quiet and alone | +Video** | | +Text* | +Video** |
| Busy and alone | −Text* | +Text* | | −Audio* |
| Busy with family | | | | |
| Busy and friend | | | | |
| Busy with classmate | | | | |
| Walking alone | | +Video** | | |
| Walking with family | | | −Video* | |
| Walking and Friend | | | | |
| Walking and classmate | | | | |
| Vehicle with family | | | | +Video** |
| Vehicle with friend | | | | |
| Vehicle with classmate | | | | |

* and ** significant for $P < .05$*, and $P < .01$**, respectively. "+" indicate positive correlation and "−" for negative correlation

goal-directed. Moreover, in second position in terms of positive correlation, *Emotional-Stability* and *Agreeableness* strongly correlate towards each other (refer to Table 11). Accordingly, both traits are strongly correlated to *Conscientiousness*, and they are both correlated to each other.

In terms of differences, we have seen that Australians with high emotional stability unwelcome podcasting while in unformal social contexts such as friends and families. It appears that Saudis with high agreeableness unwelcome podcasting in both formal and unformal social contexts such as friends, classmates, and families.

### 4.3 Conclusion based on VARK and Big 5

We can have valuable conclusions based on our correlation analysis for VARK, Big 5 personality traits, and students' preferences. This is simply because the type of podcast can be predicted by VARK and podcast length such as (short, medium, or long) can be predicted by Big 5.

**Table 9** Defining contexts correlated with VARK in Australian context

| Context/VARK | VARK subclasses | | | |
|---|---|---|---|---|
| | Visual | Aural | Read/Write | Kinesthetic |
| Quiet and alone | Positive correlation with video | | | |
| Busy and alone | | Positive correlation with audio and SLIDES | Positive correlation with text | |
| Busy and Friend | | | Negative correlation with audio | |
| Busy and classmate | | Positive correlation with Audio, SLIDES, and Video | Natural | |
| Walking and friend | | | Negative correlation with SLIDES and Video | Negative correlation with text |
| Walking and classmate | | | | Negative correlation with text |

**Table 10** Defining contexts correlated with VARK in Saudi context

| Context/VARK | VARK subclasses | | | |
|---|---|---|---|---|
| | Visual | Aural | Read/Write | Kinesthetic |
| Quiet and alone | Positive correlation with video | | Positive correlation with text | Positive correlation with video |
| Busy and alone | Negative correlation with text | Positive correlation with text | | Negative correlation with audio |
| Walking and alone | | Positive correlation with video | | |
| Walking and family | | | Negative correlation with video | |
| Vehicle and family | | | | Positive correlation with video |

**Table 11** Correlation among big five factors

| Correlation | Emotional stability | Agreeableness |
|---|---|---|
| Conscientiousness | 0.405 | 0.375 |
| Emotional stability | 1 | 0.271 |
| Agreeableness | 0.271 | 1 |
| Openness | 0.180 | 0.258 |
| Extraversion | 0.199 | 0.144 |

Tables 5 and 6 show mobile learners' attitude towards podcast in general based on personality traits. These attitudes have a number of positive and negative relations towards podcast length in specific contexts. On the other hand, Tables 7 and 8, show mobile learners' attitude towards podcast type based on learning style which also show positive and negative relation towards podcast type in specific contexts. Having both personality type and learning style can support us to predict a general attitude toward podcast in both cases (length and type). For example, giving a Saudi has a high score on openness and read/write in quiet context please refer to Tables 6 and 8, it is highly recommended to deliver a long text as learning materials. On the other hand, we have a good indication from personality type and learning preference (VARK), which contexts where mobile learners are willing to have short or limited podcast length. For instance, giving an Australian with high score on agreeableness and visual in quiet context (Tables 5, 7), it is recommended to have short videos as learning material.

## 5 Conclusion

Our research has investigated m-learning preferences in different cultures and contexts, and personalized m-learning preferences utilizing big five and learning preferences. The study has shown that association between VARK, personality traits and m-learning preference exists especially for emotional-stability and agreeableness traits. Also, aural and read/write preference have shown an association in stationary contexts with m-learning preferences. More research is needed to better understand m-learning

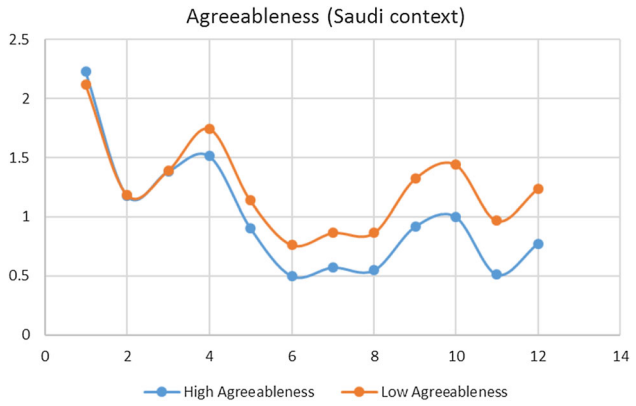


**Fig. 2** Saudi mobile learners with high and low agreeableness scores. The 12 contexts have been ordered as (1) quiet and alone, (2) busy with a classmate, (3) busy alone, (4) walking alone, (5) walking with classmate, (6) busy with a friend, (7) walking with family, (8) busy with family, (9) vehicle with classmate, (10) vehicle with family, (11) walking with a friend, (12) vehicle with a friend

preferences by expanding the designed context, utilizing learning styles, conducting lab or field studies, and developing learning materials. For example, it is clear that current podcast types are not suited for social environment. It is possible that we could develop learning materials which people with high agreeableness and emotional-stability will be willing to use while in company.

**Acknowledgements** Authors would like to thank Abdullah Alsedrani, Ashleigh Dempster, Chris Chow, Leana Copeland, and Norah Al-Ismail who helped on data collection for this project.

## References

1. International Telecommunication Union (2012) Key Global Telecom Indicators for the World Telecommunication Service Sector. http://www.itu.int/ITU-D/ict/statistics/at_glance/keytelecom.html
2. Quinn C (2000) mLearning: mobile, wireless, in-your-pocket learning. Linezine, 2000. Available at http://www.linezine.com/2.1/features/cqmmwiyp.htm
3. Georgiev T, Georgieva E, Smrikarov A (2004) M-learning—a new stage of E-learning. In: International conference on computer systems and technologies—CompSysTech
4. Parsons D, Ryu H (2006) A framework for assessing the quality of mobile learning. In: Proceedings of the international conference for process improvement, research and education. Citeseer
5. Sprague D, Pixley C (2008) Podcasts in education: let their voices be heard. Comput Sch 25(3–4):226–234
6. Gunawardena D, Karagiannis T, Proutiere A, Vojnovic M (2009) Characterizing podcast services: publishing, usage, and dissemination. In: Proceedings of the 9th ACM SIGCOMM conference on internet measurement conference. ACM, Chicago, pp 209–222
7. Van Zanten R, Somogyi S, Curro G (2012) Purpose and preference in educational podcasting. Br J Educ Technol 43(1):130–138
8. Giannakos MN, Jaccheri L, Krogstie J (2016) Exploring the relationship between video lecture usage patterns and students' attitudes. Br J Educ Technol 47(6):1259–1275
9. Collier-Reed BI, Case JM, Stott A (2013) The influence of podcasting on student learning: a case study across two courses. Eur J Eng Educ 38(3):329–339
10. Sutton-Brady C, Scott KM, Taylor L, Carabetta G, Clark S (2009) The value of using short-format podcasts to enhance learning and teaching. ALT-J, Res Learn Tech 17(3):219–232
11. Kay R (2012) Using video podcasts to enhance technology-based learning in preservice teacher education: a formative analysis. J Inf Technol Appl Educ 1(3):97–104
12. Parson V, Reddy P, Wood J, Senior C (2009) Educating an iPod generation: undergraduate attitudes, experiences and understanding of vodcast and podcast use. Learn Media Technol 34(3):215–228
13. Shih J-L, Chu H-C, Hwang G-J, Kinshuk (2011) An investigation of attitudes of students and teachers about participating in a context-aware ubiquitous learning activity. Br J Educ Technol 42:373–394. doi:10.1111/j.1467-8535.2009.01020.x
14. Chiou C-K, Tseng JCR, Hwang G-J, Heller S (2010) An adaptive navigation support system for conducting context-aware ubiquitous learning in museums. Comput Educ 55(2):834–845
15. Sharples M, Arnedillo-Sánchez I, Milrad M, Vavoula G (2009) Mobile learning. In: Balacheff N et al (eds) Technology-enhanced learning. Springer, Dordrecht, pp 233–249
16. Feng X, Asabere NY, Ahmed AM, Jing L, Xiangjie K (2013) Mobile multimedia recommendation in smart communities: a survey. IEEE Access 1:606–624
17. Kukulska-Hulme A, Sharples M, Milrad M, Arnedillo-Sanchez I, Vavoula G (2009) Innovation in mobile learning: a European perspective. IGI Global, pp 13–35
18. Adomavicius G, Tuzhilin A (2011) Context-aware recommender systems. In: Ricci F et al (eds) Recommender systems handbook. Springer, New York, pp 217–253
19. Khalil A, Connelly K (2006) Context-aware telephony: privacy preferences and sharing patterns. In: Proceedings of the 2006 20th anniversary conference on computer supported cooperative work. ACM, Banff, pp 469–478
20. Fleming ND, Mills C (1992) Not another inventory, rather a catalyst for reflection. Improv Acad 11:137–142
21. Fleming ND (2009) VARK. A guide to learning styles. The VARK questionnaire. http://vark-learn.com/introduction-to-vark/research-statistics/?p=research
22. Ormond PR (2008) Podcasting enhances learning. J Comput Small Coll 24(1):232–238
23. Yau JY-K, Joy M (2006) Application of learning styles for effective mobile learning. In: Mobile learning 2006. Eire, Dublin
24. Ozata FZ, Keskin NO (2014) Students' preferences and opinions on design of a mobile marketing education application. Turk Online J Distance Educ 15(1):189–205
25. Rogerson-Revell P, Nie M, Armellini A (2012) An evaluation of the use of voice boards, e-book readers and virtual worlds in a postgraduate distance learning applied linguistics and TESOL programme. Open Learn J Open Distance e-Learn 27(2):103–119
26. John OP, Srivastava S (1999) The big five trait taxonomy: history, measurement, and theoretical perspectives. In: Pervin LA, John OP (eds) Handbook of personality: theory and research, vol 2. Guilford Press, New York, pp 102–138
27. Yamin M, Matar R (2016) e-Government in Saudi Arabia—an empirical study. BVICAM's Int J Inf Technol (BIJIT) 8(1):944–949
28. Yamin M, Aljehani SA (2016) E-learning and women in Saudi Arabia: an empirical study. BVICAM's Int J Inf Technol (BIJIT) 8(1):950–954
29. Al Makrami AA (2015) Cloud computing in SMEs: case of Saudi Arabia. BVICAM's Int J Inf Technol (BIJIT) 7(1):791–794
30. Yamin M (2015) Health management in crowded events: Hajj and Kumbh. BVICAM's Int J Inf Technol (BIJIT) 7(1):791–794