

Impact of a Learner's Personality on the Selection of the Next Learning Activity

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Abstract. This paper investigates the impact of personality (openness to experience, emotional stability and self-esteem) on the selection of learning activities. We ran six focus groups. The research findings showed a clear impact of these personality traits on the selection of the next learning activity. Personality influenced the selection of both the type and quantity of required prior knowledge and the type and quantity of knowledge taught. Personality also influenced the other learner and learning activity characteristics that should be considered.

Keywords: Personality · Learning activity selection · Adaptation

1 Introduction

A main role of Intelligent Tutoring Systems (ITS) is to support learners to find the right learning activities that satisfies their ability. Adapting ITS to individual learner characteristics helps learners to achieve learning goals and support personalized learning [4, 5, 12]. Researchers have shown an increased interest in adapting to learner characteristics such as personality traits, motivation, performance, cognitive efficiency, learning style [1, 2, 9, 18, 23, 25, 27, 29, 30, 33, 39]. In this study, we address the problem of learning activity selection for learners with different personality traits. Several ITS studies have investigated adapting learning activity selection. For example, an adaptive exercise selection framework has been presented based on a learners personality (self-esteem), mental effort and performance [26, 27] which adapted the difficulty level of the next exercise. A navigation agent has been developed for adapting the selection of the next lesson to the learner's goals and prior knowledge [21]. Adapting the selection of learning tasks, in terms of inclusion of examples, to a learner's cognitive efficiency has been studied [24]. Other studies on the adaptive selection of topics and learning content include [32, 35, 38]. The focus of this study is to investigate the impact of three personality traits (openness to experience, emotional stability and self-esteem) on the selection of the next learning activity, taking into account the use of prior knowledge and topics taught.

Learner's Personality. The Big Five personality traits model has been a point of reference in a wide range of behavioral and psychological research. This model

is consisting of five dimensions: (i) extroversion, (ii) agreeableness, (iii) conscientiousness, (iv) emotional stability, (v) openness to experience [22]. Several investigations have confirmed the impact of personality in the learning environment. Positive correlations have been found between four personality traits (extroversion, agreeableness, conscientiousness, openness) and the learner’s motivation to attend college [7]. The effect of conscientiousness and openness to experience on a learner’s performance, motivation and academic achievement has been studied [7, 14, 17]. It has been shown that certain personality traits consistently correlate with learner achievement and success [18]. Recently published studies from the field of educational psychology found that the Big Five personality traits are a reliable predictor of academic achievement [30]. In this paper, from the Big5 traits we will study openness to experience and emotional stability, as we expect those to be most relevant to the selection of learning activities. In addition, we will study self esteem. Self esteem is defined as how favourably a person regards oneself [31], and is seen as an important component of personality [20]. It is one of the most widely studied personality concepts in psychology [16]

Prior knowledge Numerous terms have been used to refer to prior knowledge (e.g. current knowledge, expert knowledge, personal knowledge and experiential knowledge) [10, 11]. Interest in a learner’s prior knowledge has appeared in many educational studies. An individual’s prior knowledge is considered as a set of skills, or abilities that are present in the learning process [15, 34]. Previous investigations have demonstrated the potential impact of prior knowledge on cognitive processes, with positive and significant effects on learner’s performance, abilities, exam performance and achievement [6, 11, 13, 36, 37].

2 Focus Group Design

To investigate the impact of personality on learning activity selection, we used focus groups (FGs). Focus groups are valid for obtaining in-depth discussion regarding participants preferences, perceptions, opinions and behaviors [3, 19, 28]. In this case, they will provide us with learners’ opinions on how to adapt, which can inspire an algorithm, in line with work by [9, 27]. We considered three personality traits, in particular, **openness to experience (OE)** (inventive and curious vs. conservative and cautious), **emotional stability (ES)** (sensitive-nervous vs. secure and confident) and **self-esteem (SE)** (high vs. low). Six FGs were conducted: PG-1 and UG-1 discussed openness to experience, PG-2 and UG-2 discussed emotional stability, and PG-3 and UG-3 discussed self-esteem.

2.1 Participants

A total of 28 full-time Computing Science students participated in the FGs. Participants were recruited in Human Computer Interaction (HCI) practical classes for undergraduate and postgraduate students in the University of Aberdeen. Participants were told that their participation was voluntary and provided informed consent. Ethical approval was obtained from the University’s Engineering

and Physical Sciences Ethics Board. Three of the FGs consisted of postgraduate students (PG-1, PG-2, and PG-3), and three of undergraduate students (UG-1, UG2, and UG-3). The FGs were organized to facilitate discussion among participants. Each FG contained a small group of 3 to 6 participants and lasted about 35 minutes. See Table 1 for demographics.

Table 1. Participant Demographics

Groups	Participants	Male	female	Personality Traits
PG-1	5	5	-	Openness to experience
PG-2	5	2	3	Emotional stability
PG-3	5	4	1	Self-esteem
UG-1	4	2	2	Openness to experience
UG-2	3	3	1	Emotional stability
UG-3	6	3	3	Self-esteem

2.2 Research Questions

This study investigates the effects of three learner personality traits (OE, ES and SE) on the selection of the next learning activity. In this study we are not interested in the impact of personality on the *style* of the learning activity (e.g. visual versus textual) as this had been studied before [2]. Rather, we investigated the number and type (new, recently taught, or old) of topics taught by a learning activity, and the number and types (old or recently taught) of its prerequisites (i.e. prior knowledge used by the learning activity).

Overall, we hypothesized that the three personality traits would matter. We hypothesised that activity selections for learners high in OE, ES, or SE would teach more new topics. We also hypothesised that selections for learners low in ES and SE may require less prior knowledge. Finally, we thought that selection might want to include some recently taught prior knowledge in order to provide a sense of continuity and enjoyment for the learner.

2.3 Materials

Personality Trait Stories and Learning Experience. FGs were shown a story about a learner which portrayed a personality trait. Six stories were used depicting three personality traits at either a low or high level: (1.) Openness to Experience (OE), (2.) Emotional Stability (ES), and (3.) Self-Esteem (SE). The OE and ES stories were developed and validated by [8], the SE story by [26]

After each personality trait story, the same information was provided on the learning experience so-far: "**Past learning experience:** *The learner has previously learned topics A and B. Most recent learning experience:* *The learner has just finished a learning activity which taught topics D and E.*"

In each story, instead of 'the learner' a common English name (such as John) was used, in line with the names used in the original story validations (which used male names for the OE and ES stories, and female names for the SE stories).

Learning Activities. FGs were shown a table with each row containing a learning activity (numbered from 1 to 18). For each activity, the table showed which knowledge it *uses* and which knowledge it *teaches*. For knowledge it uses, a distinction was made between old knowledge (topics A and B) and recent knowledge (topics D and E). For knowledge it teaches, new topics F and G could be used as well as old (A, B) and recent topics (D, E).

Table 2 summarizes the activities available to the FGs to select from, providing the same information FGs had though in a different condensed format with more meaningful codes added (O for old, R for recent and N for new knowledge). There were five groups of activities, namely activities using: (O) only one old topic, (2O) two old topics, (OR) one old and one recent topic, (R) only one recent topic and (2R) two recent topics. There were also four types of activities based on the knowledge taught: (N) one new topic, (NO) one new topic and one old topic, (NR) one new and one recent topic and (2N) two new topics.

Table 2. Learning activity selection

Uses	O		2O		O R		R		2R										
Old	A	x		x		x													
	B		x																
Recent	D					x		x		x									
	E									x									
Teaches	N	N O	N R	2N	N	N R	2N	N	N O	N R	2N	N	N O	N R	2N	N	N O	2N	
New	F	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	G			x			x				x				x			x	
Recent	E		x			x			x					x					
Old	B	x						x				x					x		

2.4 Procedure

We began each FG by describing the purpose of the study, providing information sheets and consent forms for each participant. In particular, participants were told that the purpose of FGs was to investigate the influence of personality on the selection of learning activities in order to identify important features to adapt learning content (such as learning activities) to.

Each FG was shown a story about a learner with a particular personality trait (OE, ES, or SE at either high or low level) and learning experience. The FG was asked to select the next learning activity for that learner from the table described above (*Assume you are his/her teacher, which learning activity would you select for the learner to do next?*). Participants were encouraged to make individual selections first, and then discuss these. This process was repeated using the story of another learner at the opposite end of the same personality trait. Next, FGs were asked to discuss the following questions: (1.) To what extent they think personality traits have an influence on the selected activities. (2.) What else would they like to know about each story, e.g. interest, performance, etc (3.) How much they think the selected activities would be enjoyable, would increase skills and confidence.

3 Results

3.1 Impact of personality on activity selection

Table 3 shows the activity each FG felt should be selected. Each individual in the FG first selected an individual choice, and then these choices were discussed in the FG. In some FGs this lead to all participants agreeing (for example, PG-2 for high ES), but often participants differed on opinion on the best selection. After making their selections, the FGs also discussed the influence personality on their selection.

Openness to Experience. Both FGs tended to select different activities for the high OE learner compared to the low OE learner. For high OE, both FGs only selected activities that required recently learned knowledge. In contrast, for low OE, many participants selected activities that required only old knowledge.

When discussing the selection, PG-1 group felt that high OE learners are “open to learn new topics” and active. UG-1 group agreed on the ability to express new knowledge by saying “push the learner to learn new topics”, high OE learners are independent and intellectual. For low OE, the PG-1 group pointed out that learners with this personality are more likely to “avoid too many changes”. UG-1 group mentioned that “old and recent knowledge keep the learner learning continuously”.

Emotional Stability. Both FGs clearly selected different activities for the high ES learner compared to the low ES learner. One FG (UG-2) selected activities with more new material to learn (2N versus N or NR) for high ES compared to low ES. The other FG (PG-2) tended to select activities that require more previous knowledge (O R versus R or O) for high ES compared to low ES, whilst keeping the amount of new material learned the same.

PG-2 felt that learners with high ES are more self-satisfied and controlled. UG-2 mentioned the ability to learn new things, “he/she doesn't mind taking new topics”. For low ES, PG-2 considered the learner to be self-pitying, “insecure” and always “need to be in comfort zone”. UG-2 mentioned the learner being passive, always “seeking help” and “in fear of change”.

Self-Esteem. Both FGs clearly selected different activities for the high SE learner compared to the low SE learner. For high SE, both FGs agreed to select activities that involved more material to learn (2N versus N or NR) for high SE compared to low SE. Additionally, most participants in the two FGs selected activities that required only old knowledge for low SE, whilst most selected activities that required recent knowledge for high SE.

Both FGs hold the same opinion that learners with high SE are “willing to learn and try new things”, feeling confident and capable. For low SE, PG-3 pointed out the learner's perception of having poor abilities, whereas UG-3 strongly felt that the lack of confidence and negativity should effect the selection for learners with low SE.

Overall, we did indeed find that the three personality traits matter for selecting the next learning activity. The results for our other hypotheses were not fully in

Table 3. Participants selection

Stories	Groups		O				2O			O R				R				2R			
			N	NO	NR	2N	N	NR	2N	N	NO	NR	2N	N	NO	NR	2N	N	NO	2N	
OE	PG-1	High								✓	✓	2							✓	2	
		Low				✓	2	✓				✓	2								
	UG-1	High							✓		✓	✓	✓							✓	
		Low					✓	✓	✓		✓	✓									
ES	PG-2	High							✓	5											
		Low	✓				✓				✓		✓	2							
	UG-2	High											✓							✓	2
		Low										✓								✓	2
SE	PG-3	High						✓	2				✓	3							
		Low					✓	✓	3			✓									
	UG-3	High							✓	2			✓	3							✓
		Low		✓				✓	3						✓	2					

line with what we expected, though there were indeed impacts of personality on both the required prior knowledge and the knowledge taught. For learners low in the traits, FGs tended to select activities that either required less prior knowledge, required old knowledge rather than recent knowledge, or taught less new knowledge. FGs did not really always include the use of recent prior-knowledge, in particular not for learners low in the traits.

3.2 The influence of other factors

FGs were asked to discuss if they would have liked to know more about the learner depicted in each story to inform their selections. Table 4 shows the factors mentioned. Overall, the factors mentioned clearly differed depending on the level (high or low) of the personality traits.

Openness to experience. For high OE, FGs mentioned the learner’s limitations (how much they would be able to cope with), interests and abilities. For low OE, FGs mentioned academic record (grades), learning difficulty (how difficult the activities would be for this particular learner), and the learner’s interests (“what he/she likes”).

Emotional stability For high ES, FGs mentioned the challenges inherent in the activities (which is related to learning difficulty, but subtly different) and the learner’s abilities. For low ES, FGs mentioned the learning difficulty, the learner’s grades, feelings, and even the relations with their family/peers.

Self-esteem For high SE, FGs mentioned ability, interests, and academic record. Regarding ability, they were particularly interested in “how fast he/she learns things?”. Regarding academic record, they wanted to know whether the learner’s confidence was only based on a perception they had of themselves or whether it was also matched by their performance. For low SE, FGs mentioned learning

difficulty and academic record (grades and performance).

Table 4. Other factors FGs felt should be considered for activity selection. Number of x indicates number of FGs.

Stories	Additional Factors						
	Interests	Ability	Limitations	Academic record	Difficulty/Challenges	Feelings	Relations
High-OE	x	x	xx				
Low-OE	x			xx	x		
High-ES		x			xx		
Low-ES				xx	xx	x	x
High-SE	x	xx		xx			
Low-SE				xx	xx		

Interestingly, the learner’s academic record was seen as important by all FGs for learners who were low in the traits, for whom FGs had made more conservative selections (i.e. selections that either required less prior knowledge, required old knowledge rather than recent knowledge, or taught less new knowledge). Similarly, difficulty level/challenges were seen as important for learners low in the traits. Based on FG discussions, we conjecture that if a learner low in the traits were to have high previous performance or the difficulty of the topics was limited, then the selection might have become less conservative.

In contrast, ability and limitations (which is linked to ability) were seen as important particularly for learners high in the traits, where FGs had selected less conservative activities. Based on FG discussions, we conjecture that if a learner high in the traits were to have low ability or low limitations, then the selection might have been more conservative.

3.3 Appreciation: Enjoyment, Increasing Skills and Confidence

FGs were asked to discuss to what extent the selected activities were expected to be enjoyable for the learner, and to increase the learner’s skills and confidence. However, instead of discussing this separately for the activities they had selected for low versus high levels of the trait, FGs tended to discuss what they felt in general would be enjoyable and increase skills and confidence and then discussed how this would be impacted by the learners’ personality.

Openness to experience. In general, FGs felt that learning activities that required OR or 2R are enjoyable, and useful to increase a learner’s confidence. However, for learners with low OE, they were not sure about the learner’s appreciation of such materials, in particular the ones that required 2R. They felt that for low OE learners other factors are very relevant to consider such as the learning domain and the learner’s interests within that domain.

Emotional stability. In general, FGs felt that activities that taught more topics (2N) are enjoyable, and useful to increase a learner’s skills and confidence. However, they also felt that the appreciation of this by learners with low ES

would be lower, and could also be effected by the learner’s ability and previous grades.

Self-esteem. Both FGs mentioned that activities with more to learn (2N) are enjoyable for high SE. However, activities that required old knowledge (O or 2O) are useful to cope with the lack of confidence for learners with low SE, thus increasing their skills and confidence.

4 Conclusions

This paper studied the impact of three personality traits (OE, ES, and SE) on the selection of the next learning activity. We focused on the impact of personality on the use of prior knowledge and topics taught. FGs were conducted to provide qualitative insights. The results showed a clear impact of all three traits on the selected activities, with different activities being selected for learners high in the traits than for learners low in the traits. There were impacts of personality on both the required prior knowledge and the knowledge taught. For learners low in the traits, FGs selected activities that either required less prior knowledge (ES), required old knowledge rather than recent knowledge (OE, SE), or taught less new knowledge (ES, SE).

FGs did not always include the use of recent prior-knowledge, in particular not for learners low in the traits. They felt that using recent knowledge would add to enjoyment and confidence, but that for low SE using old knowledge may be better to increase confidence.

There were also differences in the additional factors FGs felt should be considered when selecting a learning activity. The learner’s academic record and the learning activity’s difficulty level/challenges were seen as important for learners low in the traits, and if such learners were to have high previous performance or the difficulty of the topics was limited, then the selection might have become less conservative. In contrast, ability was seen as important particularly for learners high in the traits, and if such learners were to have low ability, then the selection might have been more conservative.

Based on our results, we expect that considering learners’ personality, and learning activity characteristics (in terms of required prior knowledge and knowledge taught) in adaptive educational systems will enhance the learning experience and improve the quality of the learning activity selection. This paper used focus groups to discuss what activities to select for a particular learner. Future work will include larger scale empirical studies, studies involving teachers and studies measuring the impact of the adapted selections on actual learners. One important task of an intelligent mentoring system is to support a learner’s learning process, and helping learners to select appropriate next learning tasks. This paper provides a first step towards an adaptive algorithm for doing this.

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