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Spanning information behaviour across the stages of a learning task – where do personality and approach to studying matter?

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Abstract

Purpose - This paper will explore the role of personality (intellectual curiosity, conscientiousness and negative emotionality) and approach to studying (deep, strategic and surface) on students' learning-related information behaviour in inquiry tasks.
Design/methodology/approach - Data was collected from 219 senior high school students with the use of three questionnaires.
Findings - The findings showed that students' individual traits influenced different aspects of their learning-related information behaviour from information need to information use.
Research limitations/implications - The results were based on survey data. Reliability issues with the scales are discussed. In future research qualitative data would enrich our understanding of the phenomena.
Practical implications - The results are informative for teachers and librarians who guide students in inquiry tasks.
Originality/value - The study spanned learning-related information behaviour across the whole inquiry process: from task construction through task performance to task completion. The findings showed that individual traits were particularly influential at the task completion stage, that is on information use.

1. Introduction

Nigel Ford was one of the first to acknowledge the importance of individual differences in learning-related information behaviour (1979, 1986). Following Nigel's pioneering work, a large body of research has identified how various affective, motivational or cognitive differences play out as we interact with information (Bawden & Robinson, 2011; Ford, 2004). In conjunction with the general emphasis in information research, however, the earlier work has largely focused on information seeking. A holistic conception of learning-related information behaviour would include the whole process from information need to information use. Inspired by Nigel and building on his work, this study will explore the role of personality and approaches to studying on students' learning-related information behaviour in inquiry projects, spanning their inquiry from task construction to task completion.

In educational psychology, a long research tradition has shown that personality traits influence academic achievement of students from primary school to university (Laidra, Pullman & Allik, 2007; O'Connor & Paunonen, 2007; Poropat, 2009). The role of conscientiousness, openness to experience and negative emotionality is particularly noteworthy (O'Connor & Paunonen, 2007; Poropat, 2009). It makes sense from a theoretical perspective that these traits would be influential. Conscientious persons are hard working, open persons are intellectually curious, and negative emotionality may be distracting in a learning process. Similar trends have been found in an information behaviour context where conscientiousness has been related to persistence, openness to broad exploration and negative emotionality to lack of involvement (Heinström, 2010). The results have, however, been far from conclusive (Heinström, 2013). Just as in educational psychology, where trends mainly have been identified on a broad over-arching level (O'Connor & Paunonen, 2007), we lack an in-depth understanding of how personality plays out in learning-related information behaviour. It would be important to identify, for instance, which elements of information behaviour are related to personality and which are not (see, for instance Stokes and Urquhart, 2011). The relative impact of personality as compared to contextual or demographical influences also remains unclear (for various results see Heinström, 2002; 2005; Hyldegård, 2009; Kwon & Song, 2011).

In addition to personality traits, approaches to studying have been identified as important factors that influence learning-related information behaviour (Ford, 2004). Whereas personality traits describe a person's general behaviour across contexts, such as a propensity for being intellectually curious, conscientious or worried, an approach to studying specifically accounts for students' conceptions of learning and their motivation, whether students' approach their task mechanically or with an intention to understand or achieve (Entwistle, 2001). If we are to understand individual differences in students' learning-related information behaviour it would be important to include both perspectives. Approaches to studying would likely influence students' motivational paths through learning assignments, while personality traits would reflect their typical behaviour both within and outside learning contexts.

2. Aim of the study and research questions

The aim of the study was to explore whether and how high school students' self-reported learning-related information behaviour could be associated with their personality traits and approaches to studying. Of particular interest was to investigate their behaviour at different stages of an inquiry learning task: task construction, task performance and task completion (Tanni & Sormunen, 2008).

The research questions were as follows:

1. Do students' personality traits influence their learning-related information behaviour on the task construction, task performance and task completion stages of an inquiry learning task, and if so, how?

2. Do students' approaches to studying influence their learning-related information behaviour on the task construction, task performance and task completion stages of an inquiry learning task, and if so, how?

Task construction covers the phases from task initiation to focus formulation as characterized in the ISP model by Kuhlthau (2004). Task performance includes all activities related to information acquisition and selection of sources. Task completion concerns information use: reading sources and writing the end-product.

3. Theoretical framework

Ford's model of learning-related information behaviour forms the overall framework of the study (2004). The model highlights the complexity of information behaviour in a learning context, as influenced by cognitive and affective processes. Ford (2004, p. 184) has defined learning-related information behaviour as: "Those activities a person may engage in when, for the purposes of learning, identifying his or her own needs for information, searching for and selecting such information from multiple independent information sources, and using or transferring that information." In a school context, a typical task that involves learning-related information behaviour is inquiry learning. This is a cognitively demanding task where the learner constructs meaning from independently retrieved information sources and present his/her conclusions in form of a product such as an essay (Tanni & Sormunen, 2008). A reading-to-write task requires the learner to take on two concurrent roles: the one of a reader building meaning from a text and the one of a writer building meaning for a product, such as a text (Spivey, 1997, 136).

An inquiry learning process consists of a number of stages as presented in the well-known Information Search Process (ISP) model by Kuhlthau (2004). In several studies, the ISP model has been reduced to three partially overlapping cyclic stages: task construction, task performance and task completion (Tanni & Sormunen 2008; Vakkari & Hakala 2000; Vakkari 2001). Here we take the ISP derivative (Tanni & Sormunen, 2008) as our starting point (Figure 1). The advantage of this model is that it separates the process of learning (cognitive level) from the process of documentation and communication (behavioural level). The levels help, for example, to discuss differences in learners' goals. Information searching is likely to occur at all stages of an inquiry learning task. For the sake of simplicity, however, we consider information searching as a subtask of task performance in this paper.

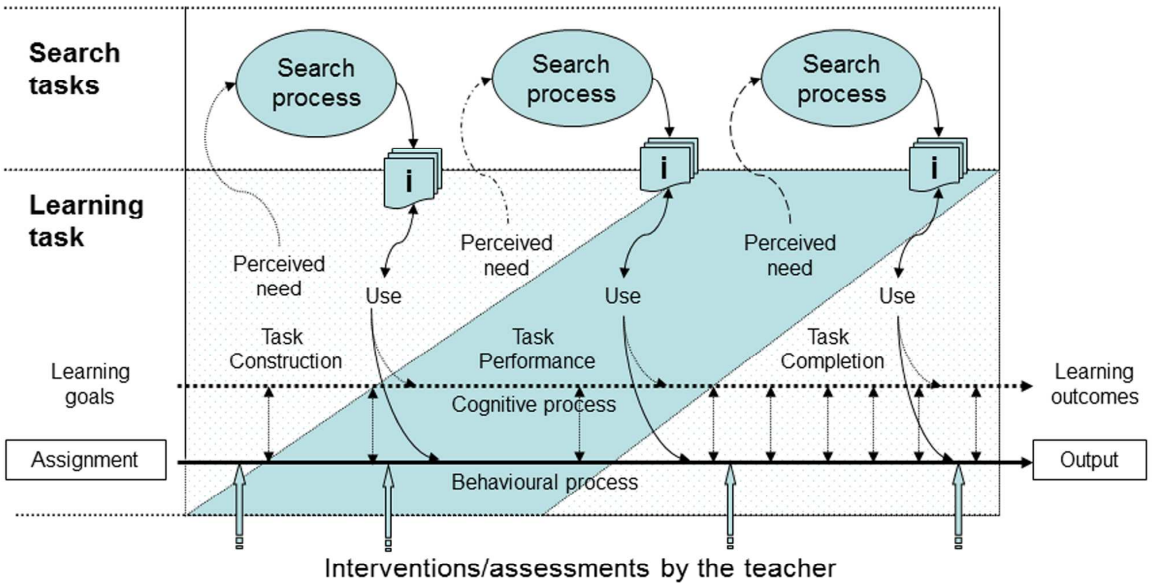

Figure 1. A process model of information behaviour in assigned learning tasks. (revised from Tanni & Sormunen, 2008)

The theoretical basis for the study of personality is the five-factor model, currently the most agreed-upon model of personality (Revelle, Wilt & Condon, 2011). This model describes personality along five central dimensions (McCrae, Costa & Paul, 2008). The personality traits in focus will be openness to experience, conscientiousness and negative emotionality, which have proved particularly relevant in a learning context (O'Connor & Paunonen, 2007; Poropat, 2009). Open persons are unconventional, curious and enthusiastic while conscientious persons are efficient, thorough and methodical. People with high negative emotionality, in turn, are reactive and sensitive with frequent feelings of anxiety and worry (Costa & McCrae, 1992).

Entwistle's model will frame the study of approaches to studying. Students with a deep approach have an intention to understand for themselves and strive to relate ideas. Surface students strive to cope with course requirements and often struggle to understand the ideas that are presented. Strategic students, finally, are well-organized and strive to achieve by adapting to perceived course requirements (Entwistle, 2001). Approaches to studying may be seen as styles that originate in personality but are moderated by experience and situational influences (Swanberg & Martinsen, 2010). They would thereby be an example of "characteristic adaptations": adaptations that form over time as personality traits interact with the environment (McCrae & Costa, 1995, p. 237, cited from Swanberg & Martinsen, 2010). Following this reasoning, it is not surprising that approaches to studying have been found to have a mediating effect between personality and academic performance (Swanberg & Martinsen, 2010). It is important to note, however, that each approach to studying may be influenced by clusters of personality traits, rather than single traits (Diseth, 2003, 2013; Chamorro-Premuzic & Furnham, 2008). This shows that despite their relation, the five-factor model personality traits and approaches to studying are distinct rather than overlapping constructs (Chamorro-Premuzic & Furnham, 2008).

4. Literature review

4. 1. Openness to experience, conscientiousness and negative emotionality: influence on learning-related information behaviour

In an inquiry learning task the learner sets out to create his/her personal understanding of a topic based on independently retrieved information sources (Tanni & Sormunen, 2008). This explorative way to learn seems particularly suited for students with high openness to experience, who are intellectually curious and have a high need for cognitive stimulation (McCrae & Costa, 1997). Inquiry learning involves two intertwined aspects of exploration: finding information sources and investigating the ideas they contain. Openness has been related to both of these aspects. Open students tend to feel excited when they look for information (Halder, Roy & Chakraborty, 2010; Heinström, 2002; 2005; Hyldegård, 2009; Stokes & Urquhart, 2011). They generally experience few obstacles in the search process and tend to feel content throughout (Halder, Roy & Chakraborty, 2010). Open students' search style is often more of an open investigation than a structured and goal-oriented quest (Heinström, 2002, 2003, 2005). Openness to experience has, for instance, been related to unstructured information-seeking, such as browsing, while being negatively related to defining the problem and identifying keywords (Stokes & Urquhart, 2011). Some studies have found that this flexible search style reflect into use of a broad range of resources (Halder, Roy & Chakraborty, 2010; Heinström, 2005), while others have not confirmed this finding (Stokes & Urquhart, 2011). Typical for open people is to be analytical with a need to understand new ideas that they come across (McCrae & Costa, 1997). This curiosity has also been found to reflect into information behaviour. Innovative, open, and creative people with high levels of intellectual curiosity tend to be process oriented, and enjoy exploring texts that bring them new ideas and insights (Heinström, forthcoming 2014; Jacobsen, 1998; Kirton, 1989; Palmer, 1991).

One of the challenges of inquiry learning is for students to reflect upon the information they find and analyze it critically instead of merely look for "facts" (Alexandersson & Limberg, 2003). Openness may bring an advantage to this process through the trait's typical cognitive fluency in divergent thinking, abstract and verbal reasoning, and critical reflection (Bidjerano & Dai, 2007). Research has found that open students are self-confident regarding their information evaluation and search skills (Kwon & Song, 2011). They also tend to experience few problems in critical analysis of documents (Heinström, 2003). The final step of inquiry is to actually learn from the information that has been retrieved. The relationship between openness and academic achievement is, however, not clear, as some studies have found a relation while others have not (O'Connor & Paunonen, 2007).

Inquiry involves exploration and independent work, but typically students need to present what they have learnt in form of a product. Exploration is therefore only one aspect of an inquiry learning task, the other part is to bring information together to create a product according to task requirements. This is where conscientiousness comes in, a trait linked to self-discipline and reliability.

Conscientiousness has consistently been found to have a strong influence on learning processes, across ages and in various learning contexts (O'Connor & Paunonen, 2007; Poropat, 2009). Similarly, conscientiousness has been found to be the personality trait with the strongest impact on students' information behaviour (Halder, Roy & Chakraborty, 2010). Conscientious students are

generally achievement oriented and motivated to perform well in their school assignments. They, moreover, have the self-discipline and dutifulness that this often requires (O'Connor & Paunonen, 2007). One expression of conscientiousness is structured and organized behaviour in a learning context. Conscientious students are efficient in organizing their studies and managing their time (Bidjerano & Dai, 2007). This methodical way to study also plays out in an information seeking context. A common search approach for conscientious students is structured and organized seeking with a distinct focus on high quality sources (Heinström, 2002). In addition, the trait triggers behaviour that support learning processes, such as persistence and high study morale. Conscientious students tend to work industriously on their assignments and be careful to fulfil task requirements (O'Connor & Paunonen, 2007). Conscientious students have similarly been found to be active information seekers who invest effort in pursuit of relevant information (Halder, Roy & Chakraborty, 2010; Heinström, 2002, 2003). They may even collect information, which turns out to be superfluous for their goals, such as passing a test, just to make sure they do not miss out on anything essential (Ishida, 2005). Conscientious students have also demonstrated high academic morale when it comes to ethical information use. They are unlikely to resort to e-dishonesty such as plagiarism and falsification (Kwon & Song, 2011).

Persons with high negative emotionality are sensitive and reactive, and suffer from a heightened likelihood to experience difficult emotions, such as anxiety, worry, and sadness (Costa & McCrae, 1992). In a learning situation the impact of negative emotionality may be twofold. Worry may lead to better preparation and increased effort in an attempt to avoid an expected failure (Komarraju, Karau & Schmeck, 2009). When the anxiety is too strong, however, it often becomes intrusive for learning processes by consuming cognitive capacity and distracting attention (Laidra et al., 2007). The impairing influence of negative emotionality is particularly strong during demanding and stressful tasks. Inquiry projects come with several potentially stressful elements. The students need to work independently, analyze their task and its requirements, manage an open information environment, analyze and compile what they find, and finally present a product. Each of these steps contains their own challenges. Research has found that there are several stressful elements of inquiry which evoke anxiety in students (Abusin, Zainab & Karim, 2011; Kracker & Wang, 2002; Kuhlthau, Heinström & Todd, 2008). These feeling of anxiety are temporary and task-related, but students with negative emotionality are more vulnerable to stressors like these. Negative emotionality has been found to have a negative effect on university students' thesis research (Chamorro-Premuzic and Furnham, 2003).

In an information seeking context, negative emotionality has been linked to lack of motivation, as well as with insecurities while searching (Halder, Roy and Chakraborty, 2010; Heinström, 2002; 2005). This can create a vicious circle as anxiety in turn infers with search processes (Ford et al., 2001). If students' anxiety is strong, students at times disengage from the whole learning process, as they are not able to organize and categorize what they learn into meaningful wholes (Komarraju et al., 2011). Anxiety may have a similar impact on analytical ability in information processes, where it may impede critical evaluation (Kwon, 2008). It should be noted that there have been studies that have found no link between negative emotionality and feelings of competence in information seeking and evaluation processes (Kwon & Song, 2011). The influence of negative emotionality on information behaviour may also be moderated by the learning context, such as being part of a group (Hyldegård, 2009). Similarly, there have been studies that have found no relation between negative emotionality and academic performance (O'Connor & Paunonen, 2007).

4. 2. A deep, strategic and surface approaches to studying: influence on learning-related information behaviour

Defining for a deep approach is the intention to create a personal understanding of a subject by linking together pieces of information and connecting new information to previous understanding (Entwistle, 2001). This process of knowledge construction reflects into students' learning-related information behaviour. In inquiry projects it has been found that deep high school students look for a personal angle to their topics by relating it to their previous knowledge or interest (Heinström, 2006). As their goal is a personal understanding it is important for them that the information they consult is of high quality (Heinström, 2006). Deep students tend to be explorative rather than structured when they search for information, using strategies like breadth exploration, networking, browsing and sifting. A deep study approach does not, however, exclude a certain amount of structure in the search process such as identification of keywords (Stokes & Urquhart, 2011).

Typical for strategic students is to be organized, efficient, and achievement-oriented (Entwistle, 2001). We can see reflections of strategic students' efficiency in their information seeking that tends to be structured and well-organized (Heinström, 2002; 2005; Stokes & Urquhart, 2011). A strategic approach has been linked to attention to problem definition, keyword searching, refining and sifting in the search process (Stokes & Urquhart, 2011). In inquiry projects strategic high school students tend to be methodical in their work and make sure that they complete task requirements (Heinström, 2006). Effective time management is a proven asset that leads to effective information retrieval (Ford, Miller & Moss, 2001). Particularly the combination of a deep and strategic study approach has been found to result in focused, thorough and persistent information seeking (Heinström, 2002, 2005). Research shows that deep and strategic university students usually enjoy problem-based learning and are efficient in managing their time, workload and self-directed learning (Papinczak, 2009).

Students with a surface approach often find learning processes fragmented and struggle to connect subject areas. They tend to accept and memorize new ideas without questioning them and without further reflection (Entwistle, 2001). This often translates into mechanic compilation of information. In inquiry projects high school students with a surface approach tend to quickly proceed through the task, completing only the necessary requirements (Heinström, 2006). One reason may be that students try to get rid of a burdensome task with as little involvement as possible (Heinström, 2002; 2005). Surface students often fear failure and try to avoid challenges (Prat-Sala & Redford, 2010). Independent inquiry learning may appear more challenging than conventional teaching. This may create a vicious circle, as fear of failure, in turn, often leads to ineffective information retrieval (Ford et al., 2001). All these challenges add up in a low self-concept. Surface students have been found to have low self-efficacy in information seeking and depend on others in their search process (Stokes & Urquhart, 2011).

5. Method

Data was gathered in October-November 2011 in three senior high schools in Tampere, Finland by the use of three questionnaires. The respondents were 219 students of whom 34 % (n=75) were male, and 66 % (n=144) female. 30 % (n=65) of the respondents were first year students, 27 % (n=58) were second year students, 38 % (n=84) were third year students and 5 % (n=12) forth year students. The questionnaires measuring personality, approaches to studying and learning-related information behaviour respectively are presented below.

5. 1. Personality

Personality was measured by a 10 item measure of the five-factor model (Lönnqvist, Verkasalo & Leikas, 2008). The test measures each of the five dimension by two items (each item being a pair of adjectives), giving a total of 10 items (20 adjectives). The short scale was chosen out of consideration of the overall length of the questionnaire. The two corresponding items were combined to sum variables and tested for reliability. For the purpose of this study only openness to experience, conscientiousness and negative emotionality were used in the analysis. Reliability for the scales was tested with Cronbach α and gave the following results: openness to experience (.28), conscientiousness (.59) and negative emotionality (.41). The reliability proved low for all factors, which partly may be explained by few items in the scales. Due to the low reliability, the option of using each personality item as a separate measure was investigated in explorative analyses. It was, however, concluded that this solution did not add value as compared to combining the items. Consequently the two items measuring conscientiousness and negative emotionality were combined to summary variables. The alpha for openness to experience was, however, considered to be unreasonably low. The two items that measured openness to experience were intellectual curiosity and artistic interests. For the purpose of this study, which studied learning-related information behaviour, intellectual curiosity was considered the essential aspect (see forth Von Stumm, Hell & Chamorro-Premuzic, 2011). Consequently intellectual curiosity was used as the sole scale in the following analyses.

5. 2. Approaches to studying

Approaches to studying were explored by the OPPI test (Parpala, 2010), a version of the ASSIST test (Tait, Entwistle & McCune, 1998) in Finnish. OPPI measures the three standard approaches to studying, deep, surface and strategic, and in addition a scientific approach to studying (critical and analytical). OPPI has been developed and validated among Finnish university students (Parpala, 2010). The test consists of 16 questions, four questions addressing each of the four dimensions: deep, surface, strategic and scientific. In the present study the reliability of OPPI, within a senior high school context, was first explored through an explorative factor analysis. A rotated varimax four-factor solution explained 55 % of variance. The first factor combined items designed to measure a surface study approach, and the second factor items designed to measure a strategic approach. The third factor combined the four items for a deep approach with two items of a scientific approach, leaving the forth factor with two items designed to measure a scientific approach. It was concluded that the questions for the scientific approach did not work satisfactorily in the sample, perhaps since the questionnaire was designed for university students rather than high school students. Therefore the questions measuring the three core approaches to studying: deep, surface and strategic were selected for a separate factor analysis. The rotated varimax three-factor solution explained 56 % of variance and divided the factors according to the three study approaches. The items measuring each respective study approach were summarized. Reliability for the scales was tested with Cronbach α and gave the following result: deep (.56), surface approach (.78) and strategic approach (.74). Items measuring each respective approach to studying were combined to three sum variables: deep, surface and strategic.

5. 3. Questionnaire about learning-related information behaviour

Students' learning-related information behaviour was explored through a questionnaire which consisted of 42 statements on Likert scales from 1 (strongly disagree) to 5 (strongly disagree). The questionnaire addressed information behaviour in inquiry learning tasks where students independently choose a topic, seek out information, and write an essay based on the found information. It should be noted that the questionnaire was filled out without any connection to a specific inquiry task. Instead the students were asked to describe how they generally went about inquiry.

The questionnaire sought to explore students' general information attitudes and behaviour at three phases of the process: task construction, task performance, and task completion. We investigated students' attitudes and confidence in inquiry as well as their topic preference and focus formulation as part of task construction. The middle steps of task performance formed the base for the process related questions: choice of information sources, persistence in information seeking, difficulties and search strategy. For the final step of task completion we included questions about information use in the reading-to-write process, such as taking notes while reading, noting references, consulting various viewpoints and perceiving difficulties in understanding texts. We developed the scales by combining inter-correlated items and tested the reliability with Cronbach α. The Cronbach α's ranged between .40 to .79 (see Appendix 1). Most scales had a fairly low Cronbach α. This may be due to few items in the scale but remain problematic.

Regression analyses were used to explore the influence of the independent variables as predicting the dependent variable.

6. Results

6.1. Relationship between personality and approaches to studying

The five-factor model personality traits and approaches to studying have been connected in previous research (Furnham, 2011). It was therefore important to establish their relationship in our data before we begun to answer our research questions. This analysis was done by regression analyses using a stepwise general linear model.

A regression analysis showed that intellectual curiosity (β=.29, $t(211) = 4.69$, p=.000) and low negative emotionality (β=-.14, $t(211) = -2.10$, p=.04) significantly predicted a **deep** approach to studying. Intellectual curiosity and low negative emotionality explained a significant proportion of variance scores, R^2=.11, $F(1, 210)$ =13,36, p=.000. A deep approach has been related to openness in several studies (Furnham, 2011). The connection between a deep approach and low negative

emotionality has also been found (Chamorro-Premuzic & Furnham (2008). A deep approach is, furthermore, often linked with conscientiousness (Furnham, 2011). This connection was not found in the present study. Personality traits explained 11% of variance of a deep approach. This suggests that although a deep approach is linked to personality, the variable is largely explained by other factors.

A regression analysis showed that conscientiousness (β=.51, $t(208) = 8.49$, p=.000) significantly predicted a **strategic** approach to studying. Conscientiousness explained a significant proportion of variance scores, R^2=.26, $F(1, 207)$=72.11, p=.000. Conscientiousness explained 26 % of variance of a strategic approach, which suggests a fairly strong relation. The relation between conscientiousness and a strategic approach to studying is a reoccurring research finding (Furnham, 2011).

A regression analysis showed that negative emotionality (β=.28, $t(209) = 4.40$, p=.000) and low intellectual curiosity (β=-.23, $t(209) = -3.59$, p=.000) significantly predicted a **surface** approach to studying. Negative emotionality and low intellectual curiosity explained a significant proportion of variance scores, R^2=.15, $F(1,208) = 18.20$, p=.000. Previous research has consistently linked negative emotionality with a surface approach to studying (Furnham, 2011). The link between low intellectual curiosity and a surface approach is less established but also occurs (Busato et al., 1999; Diseth, 2003). Personality traits explained 15 % of variance of a surface approach.

6. 2. Learning-related information behaviour

The next phase of the analysis was to examine how the independent variables influenced learning-related information behaviour. This was done through a regression analysis. In addition to personality traits and approaches to studying, senior high school grade was added as an independent variable to the regression in order to account for the possible impact of education. Senior high school grade was, in other words, introduced to measure the relative impact of intrinsic variables as compared to mutual elements shared by all students. The regression was conducted by a stepwise general linear model which allows for both categorical and interval data.

The analysis revealed that there was no influence of the independent variables on preference for factual over more contemplative content or on opportunistic discovery of information. Factual content preference was found to be common among all students. This may be explained by the prevailing culture in schools that unintentionally often conveys an implicitly message of the existence of right answers (Alexandersson & Limberg, 2003). Opportunistic discovery of information was also unrelated to individual differences. This finding was in contrast to previous studies (Heinström, 2007). Only results of statistical significance will be reported in the following.

The results of the regression analyses are shown in Tables 1-3. The tables will report ß values, which show the strength of the relation between the independent and dependent variable, F values which show the degree of variability that the regression model can explain, and R^2 values, which show the amount of variance explained by the model.

Table 1. The relationship between task construction (choice of topic, attitudes, confidence) and the independent variables of the study. Negative connections are noted in italic.

Information behaviour	Intellect. curiosity	Conscie.	Negative emotion.	Deep	Strategic	Surface	Grade	*F*	R^2
Choice of unfamiliar topic	ß=.20**	*ß=-.20***					*ß=-.19***	6.39***	.09
Choice of utilitarian topic					ß=.21**			9.18**	.04
Prefer teacher to suggest topic		*ß=-.16**						5.04*	.02
Inquiry as motivating				ß=.27***				16.36***	.08
Inquiry as hard work		*ß=-.28****			ß=.20**			6.47**	.06
Confidence in inquiry tasks	ß=.20**					*ß=-.35****		24.89***	.20
Focus formulation					ß=.25***			14.25***	.07

*p<.05, **p<.01, ***p<.001

Table 1 shows that at the task construction phase, the independent variables had the strongest influence on students' confidence. 20 % of variance in confidence in inquiry tasks was explained by intellectual curiosity and a surface study approach. Students who were intellectually curious found it easy to grasp what inquiry learning was about and knew how to proceed in the task, while those with a surface approach felt insecure about their ability to conduct independent inquiry.

Other noteworthy findings at this stage was that intellectually curious students preferred to choose topics that enabled them to explore new things, while conscientious students chose topics they knew from beforehand, but preferred an independent choice without input by the teacher. Strategic students chose topics of practical value and explored information sources before they formulated a focus. Deep students found that inquiry increased their study motivation and was an effective way to learn. Conscientious students did not regard inquiry as hard work, while strategic students did. Negative emotionality had no impact at this stage.

Table 2. The relationship between task performance (information acquisition) and the independent variables of the study. Negative connections are noted in italic.

Information behaviour	Intellect. curiosity	Conscie.	Negative emotion.	Deep	Strategic	Surface	Grade	*F*	R^2
Persistent seeking				ß=.19**	ß=.20**	*ß=-.19***		13.03***	.15
Varied search strategy		ß=.26***		ß=.19**			ß=.19**	11.31***	.13
Appearance related criteria						ß=.25***		13.39***	.06
Internet convenience				*ß=-.15**	*ß=-.24****			11.32***	.09
Search difficulty			ß=.23***					11.12**	.05
Difficulty in critical evaluation			ß=.22***				*ß=-.14**	7.59**	.07

*p<.05, **p<.01, ***p<.001

Table 2 shows that approaches to studying explained 15 % of variance in the amount of persistence the students invested in their information seeking. A deep and strategic approach led to high investment, while a surface approach was linked to low persistence. 13 % of variance in the degree of variation in search strategy (using other strategies than "googling" such as browsing) was explained by conscientiousness, a deep approach and a high grade. 9 % of variance of "internet convenience" was explained by a deep and strategic study approach. Students with a deep and strategic approach to studying went beyond search engines to find information and consulted a broad range of information sources.

Approaches to studying had a stronger influence than personality traits at the task performance stage. A deep study approach was the most influential, as linked to persistent information seeking, a varied search strategy and use of a variety of information sources. A strategic approach was similarly linked to persistence and use of a variety of information sources. A surface approach was linked to lack of persistence, and choosing sources by appearance. Negative emotionality was the only trait that was linked to difficulties at this stage. Students with high negative emotionality found it to be challenging to look for information and evaluate information critically. It should be noted that students at higher grades chose more varied search strategies and had less problems in critical evaluation of sources than students at lower grades.

Table 3. The relationship between task completion (reading, writing) and the independent variables of the study. Negative connections are noted in italic.

Information behaviour	**Intellect. curiosity**	**Conscie.**	**Negative emotion.**	**Deep**	**Strategic**	**Surface**	**Grade**	***F***	**R^2**
Difficulty understanding texts			ß=.20***	*ß=-.17***		ß=.34***		25.73***	.28
Noting down references as use them	ß=.21***				ß=.29***			17.69***	.15
Note taking				ß=.14*	ß=.26***		ß=.15*	9.35***	.12
Ensuring correct interpretation				ß=.19**	ß=.14*			7.42***	.07
Use of alternative viewpoints	ß=.17**			ß=.38***				27.03***	.21
Immediate writing		*ß=-.15**		*ß=-.21***	*ß=-.20***		*ß=-.23****	13.04***	.21

*p<.05, **p<.01, ***p<.001

Table 3 shows that at the task completion stage 28% of variance in the difficulty to understand texts could be explained by personal characteristics, the strongest being a surface approach, followed by negative emotionality. Students with a deep study approach had little difficulties in understanding texts. 21% of variance in the use of alternative viewpoints in the process of building an understanding of the topic was explained by intellectual curiosity and a deep approach. 21 % of variance of immediate writing was explained by personal characteristics. Conscientiousness, a deep and strategic study approach and a higher grade were all linked to getting acquainted with information sources before beginning to write.

Approaches to studying had a stronger influence than personality traits at the task completion stage. A deep study approach was the most influential variable. Deep students did not find it difficult to understand the texts that they read. They wanted to ensure that they had understood the texts

correctly by returning to them later in the process. Deep students prepared for writing by making notes, consulted a broad variety of viewpoints to ensure a nuanced perspective on the topic and familiarized themselves with the topic before they begun to write. A strategic approach to studying was also highly influential at this stage. Strategic students noted down references immediately as they used them in their texts, took notes, went back to sources to ensure that they had understood them correctly and familiarized themselves with the topic before they begun to write. A higher grade was related to more note-taking and less immediate writing.

High school grade was included in the analyses as a comparative measure of shared variance. The results showed that the individual variables, personality and approach to studying, had a stronger influence on students' behaviour than their grade. Before we move on to the discussion, we will conclude the results section by reporting the results pertaining to grade, as this was not part of our research questions. The findings showed that students of a higher grade were less likely to choose unfamiliar topics for their essays. This may be a sign of the approaching maturity exams and their increased focus on core contents of the curriculum. They used various search strategies and did not experience critical evaluation of sources as difficult. Students of a higher grade also applied advanced reading techniques (taking notes) and studied information sources before they begun to write the end-product. The results thereby suggest that the students work more thoroughly with information sources and become more confident in evaluation of information sources as they proceeded through senior high school.

7. Discussion

In the following we will discuss the findings trait by trait. We will begin by exploring how personality traits played out at the three stages of the inquiry process (task construction, task performance and task completion), and then move on to discuss the results pertaining to approaches to studying. It should be kept in mind that our results are based on self-report on questionnaires. The connection between traits and behaviour is, however, for the sake of simplicity presented as they would occur in actuality.

Intellectually curious students. At the task construction phase intellectual curiosity was a highly influential trait which particularly impacted students' information need. Intellectually curious students felt confident in their inquiry and chose unknown topics for their exploration. Intellectual curiosity was not a factor at the task performance stage, while this need for cognition appeared again at task completion as these students favored sources that contained alternative or even conflicting viewpoints. This orientation predicts high involvement in cognitive processes (learning about the topic, c.f. Figure 1). These students' epistemic beliefs also seem to be mature enough to critically assess sources (cf. Whitmire, 2003). Intellectual curiosity alone, however, did not seem to be enough for engagement in information use (cf. reading and writing by deep and strategic learners). It has been suggested that in order to achieve in a study context intellectually curious students need to channelize their need for cognition into a deep study approach (Komarraju et al., 2011). In line with previous studies (Furnham, 2011), intellectual curiosity was found to be a predictor of a deep approach. These traits are linked, but they are not identical as intellectual curiosity is driven by a need to find out (and perhaps forget) while deep students have an intrinsic interest to learn (regardless of novelty). In an inquiry process, intellectual curiosity thereby particularly influences information need, while the emphasis of a deep approach is on information use.

Conscientious students. Conscientiousness has consistently been linked to hard work both generally in studies (O'Connor & Paunonen, 2007; Poropat, 2009) and in information behaviour (Halder, Roy & Chakraborty, 2010). It was therefore surprising that conscientiousness did not seem to be a strong factor in learning-related information behaviour. Conscientious students did not regard inquiry learning as hard work and would rather choose familiar topics than challenging ones for their inquiry projects (task construction). As the project proceeded, conscientiousness was linked to a varied search strategic but did not have an impact on e.g. persistence as could have been expected (Heinström, 2003). One explanation may be that conscientiousness manifested through a strategic approach. This connection was found in the study, confirming previous research (Furnham, 2011). It may, however, also be that conscientiousness is a less strong factor in inquiry learning than it is in conventional study. Conscientious students might not invest their usual engagement in inquiry projects, but rather regard them as irrelevant extra tasks outside of actual studies. This finding raises questions that require further research.

Students with high negative emotionality. Negatively emotionality was linked to worries and anxiety at the task performance and completion stages of the inquiry process. Students with high negative emotionality felt that searching, evaluation of search results and understanding texts were difficult. This experience likely comes from a heightened sensitivity to stress, rather than being an actuality. The experience of inquiry as being challenging can also be due to a cognitive attunement to negativity (see forth Diseth, 2013). Heightened anxiety and worry is important to notice, as it has been found that whether students with negative emotionality perceive their learning environment as too burdensome (for instance in form of workload) they may adopt a surface study approach (Diseth, 2013). Our findings confirmed this previously found link between negative emotionality and a surface approach (Furnham, 2011).

Deep learners. Students with a deep approach felt that inquiry learning tasks increased their study motivation (task construction). As the task proceeded, the impact of a deep approach grew stronger. Deep students were persistent information seekers who used varied search strategies (task performance). The influence of a deep approach culminated at task completion. Deep learners had no difficulty in understanding the texts they read and were engaged in careful use of information (looking for alternative viewpoints, note taking, working with sources and ensuring correct interpretation). Learning (cognitive processes) thereby seemed to take precedence over documentation and communication (behavioural processes) for these students (see Fig. 1). Characteristic for a deep approach is to strive for a personal understanding of a topic by linking together pieces of information (Entwistle, 2001). Active use of information sources is therefore not surprising. The explicit connection between a deep study approach and thorough engagement with information sources has not, however, to the authors' knowledge, been demonstrated in previous research.

Strategic learners. Strategic students' tactical thinking and commitment to requirements manifested immediately as the task begun. A strategic approach was linked to choosing topics of utilitarian value, approaching inquiry learning as hard work and forming a focus before beginning to explore the topic. At the task performance stage strategic students persistently searched for information and consulted a broad range of sources. At task completion they were careful to note down references as they used them, took notes, ensured correct understanding of sources and read information sources before they begun to write. Taken together, this paints a picture of a somewhat idealistic behaviour in inquiry tasks. Presumably this behaviour is a reflection of the strategic students' will to achieve by abiding by task requirements. As strategic students focus more on achievement than specifically on their own learning process, as deep students do, they seem to pay relatively more attention to

documentation and communication aspects of inquiry rather than their own learning process (cf. Fig. 1).

Surface learners. At task construction students with a surface approach felt insecure and uncertain about the upcoming project. This lack of confidence, combined with conceptual challenges in understanding texts, seemed to define their whole inquiry process. At task performance they lacked persistence in information seeking and at times chose sources based on appearance. At task completion the only link to a surface approach was a struggle to understand texts. Surface students often find learning challenging, particularly when the goal is to combine various aspects to holistic conceptions (Entwistle, 2001), which is the case in inquiry learning. This may result in a low self-efficacy and define their further behaviour (c.f. Stokes & Urquhart, 2011). A surface approach to studying has been linked to avoidance coping, that is disengagement from the source of stress (Moneta, Spada & Rost, 2007). This may explain why surface students did not invest any effort in the task. Unfortunately, this may create a vicious circle, as lack of involvement may also be a reason why these students struggle to understand the information they find. Students with a surface approach seemed to focus their attention on the documented output as required by teachers in assigned learning tasks, and largely overlooked their own learning process (cf. Fig. 1).

In interpreting the results it is important to remember that individual differences are but one of many influential factors on information behaviour (see e.g. Vilar & Žumer, 2008). The limitations of the study, furthermore, need to be kept in mind. The data was gathered through questionnaires that were filled in at school. Oral and written instructions underlined anonymity and the fact that data was gathered for research purposes only. "Good respondent" tendencies can nevertheless not be ruled out, particularly in a school context where students are accustomed to being evaluated on their replies to written tests. As the findings are based on self-report, we, moreover, do not know what students in actuality do in their inquiry process. Future research would benefit from a qualitative approach which would enable in-depth analysis of students' behaviour and motivations behind them. Reliability issues were also problematic as Cronbach alphas were quite low, particularly regarding the personality measure. The low number of items may partly explain the low alphas. The used measure was, however, a validated test where appropriate alphas would have been expected (Lönnqvist, Verkasalo & Leikas, 2008). The results pertaining to personality traits should therefore be interpreted by caution. Lengthier tests for personality are recommended for future studies.

Taken together the findings show that each trait had its own emphasis in the inquiry process. At the task construction phase, intellectual curiosity and a surface approach seem to be particularly influential. Intellectual curiosity drives a motivation to explore, while a surface approach is defined by insecurity. A strategic approach is linked to abiding by formal requirements at each step of the process, while conscientiousness seems to be less influential on students' inquiry than it is in their usual study work. Negative emotionality is linked with anxiety and worry throughout the process, while a deep approach particularly manifests in information use.

8. Conclusions

The study set out to explore whether personality traits and study approaches would be influential on learning-related information behaviour in inquiry tasks. It was found that individual differences had

a stronger impact than high school grade on information behaviour. Findings from previous studies (e. g. Heinström, 2002; 2005; Stokes & Urquhart, 2011) on university students' information behaviour were largely confirmed among senior high school students operating in a structured environment with more outspoken requirements on information behaviour. This underlines the importance of considering individual differences in learning-related information behaviour.

The findings also showed that each of the traits had their own particular influence at various stages of the process. Personality traits had a stronger impact at the task construction phase, while study approaches were more influential at task performance and task completion. Overall, individual traits were most influential on the task completion stage, when students read information sources and wrote their own texts, in other words when they used information. Information use has not been much studied in earlier information research. We, therefore, regard this finding as particularly noteworthy.

9. References

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Appendix. Scales used in the study.

Scales	
Task initiation	
Choice of unfamiliar topic (multi-item)	I strive to choose a topic I know well from beforehand (reversed) + I rather choose a topic, which enables me to explore new things. Cronbach α for the scale was .40.
Choice of utilitarian topic	(If I am free to choose a topic for my essay) I try to choose a topic which is practically useful to me
Prefer teacher to suggest topic	I'd rather ask my teacher to suggest a topic for me than choose myself (for explorative assignments)
Inquiry as motivating	Independent assignments increase my motivation for studying + Independent information seeking and writing is an effective way of learning + I believe I learn more through explorative tasks than through traditional study. Cronbach α for the scale was .66.
Inquiry as hard work	Writing source-based essays is time-consuming and hard work
Confidence in inquiry tasks (multi-item)	I find it easy to find an angle from which to address my topic + It is difficult to work on inquiry assignments; I do not know how to proceed (reversed) + I know what a good inquiry essay entails + It is easy to understand what the learning goals of inquiry assignments are. Cronbach α for the scale was .70.
Focus formulation (multi-item)	Before I choose from which angle to explore my topic, I first explore information about it + I first figure out what my topic is about before I decide what information to collect. Cronbach α for the scale was .40.

Scales	
Task performance	
Persistent seeking (multi-item)	I am willing to use time and effort to search for information + If a few searches do not result in relevant results, I quit searching (reversed) + I spend time to identify the best sources and follow links forward + I choose information sources that are easily available and don't spend time on finding potentially better ones (reversed). Cronbach α for the scale was .59.
Varied search strategy (multi-item)	By browsing I find info sources that may be difficult to find simply by googling + It is important to know many various ways to search on the Internet. Cronbach α for the scale was .40.
Appearance related criteria	I reject information sources that do not look appealing
Internet convenience (multi-item)	I think it is important to know how to find information from other sources than Websites (reversed)+ I choose a broad range of information sources (Websites, books, journals, experts etc) (reversed)+ It pays off to concentrate information seeking to the Internet, since it is the easiest way + You find all essential information on the Internet through search engines. Cronbach α for the scale was .58.
Factual content preference	I choose factual sources rather than those which are contemplative
Search difficulty	It is easy to choose search terms (reversed) + It is difficult to identify the relevant information from search results + I find it difficult to search for information on the Internet. Cronbach α for the scale was .65.
Opportunistic discovery of information	One often runs into the most useful information by chance
Difficulty in critical evaluation (multi-item)	I find critical evaluation of the trustworthiness of information easy (reversed) + It is difficult to recognize bias and opinions in texts. Cronbach α for the scale was .49.

Scales	
Task completion	
Difficulty understanding texts	I often find it really difficult to understand the information I find

Noting references as use them	I write down references as soon as I use them in my text
Note taking	I prepare for writing by taking notes.
Ensuring correct interpretation	As I work on the text I often go back to sources to check that I have understood them correctly
Use of alternative viewpoints (multi-item)	I try to find several good sources in order to get alternative information + By combining various viewpoints you can create new information + Conflicting information in various sources increase my interest in the topic + Judging reliability requires information from several sources. Cronbach α for the scale was .52.
Immediate writing	Before I begin to write I get thoroughly acquainted with the whole material (reversed). + I begin writing as soon as possible and pick up information from sources as I proceed. Cronbach α for the scale was .56.