

# Developing a Study Aptitude Test for International Distance Education Students of Geoinformation Science and Earth Observation

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## Abstract

Online diagnostic study aptitude tests are a common means of helping students select the correct type of course, and the correct mode of education. However, universities often lack the data to predict critical student success factors correctly. In this paper we discuss the development of an online entrance test for a university in the Netherlands, offering courses to international students. Aim of the test is to help future students decide on the mode of education (face-to-face or distance learning). Besides the development of the entrance test we also discuss its first results and future analysis to be conducted.

## 1 Introduction

Dual-mode course delivery (face-to-face and distance education) provides universities with the opportunity to reach students that would normally be unable to participate in their course. For an international Faculty like the Faculty of Geo-Information Science and Earth Observation (ITC) of the University of Twente in the Netherlands, the step towards dual-mode education during the first modules of their curriculum seems obvious. Yet, it also poses a simple but important question: "For which students should distance education be recommended and which students should better follow face-to-face education?"

The choice of mode of education can be left completely to the student. The student can base his/her choice on experiences of previous students, and/or reviewing samples from course materials. Many universities also offer (online) diagnostic entrance tests that can help students assess their potential success as a distance education student. However, such a test should be designed based on actual knowledge of critical success factors for the course and for distance learning.

In many cases experience with previous students is taken as an indicator [18]. When a university is selecting students previously trained in their own country, the selection is relatively straightforward as they have knowledge about the secondary education system and have past experience with similar students. However, when a university is selecting international students the story becomes more complex. Besides the fact that selection of international students is more difficult, E-learning student populations differ from the regular student population and E-learning has distinct success factors not or less relevant for face-to-face learners. Designing a diagnostic online entrance test is therefore complex and should

be done with great care. This paper will show the development of such a test based on related theories and will discuss the initial results using two test groups.

## 2 Related literature

Student enrolment in online courses has greatly increased in the past years and is predicted to increase further in the coming years [1].

Several studies have been conducted regarding the reasons why students choose a certain mode of education. Institutes offering two or more modes of study want to understand the reasons why students choose a certain mode of education [2]. However there is no thorough understanding of the profile of the successful E-learner.

The current literature covers a wide range of potentially influential factors that determine student success in distance education varying from cultural challenges and ethnicity [7, 10] to family support [4] and financial matters [9]. Stewart, Chisholm [19] attribute success of E-learners to a combination of student characteristics and motivation.

McSporrán and Young [14] and Thayalan, Shanthi [20] studied the influence of gender in online learning concluding significant differences between female and male students in their motivation, social presence and in scheduling learning. Wiggam [21] and Xu and Jaggars [24] are among those who consider ethnicity as a possible influential element on persistence and adaptability and also link their findings to the quality of primary and secondary education offered to different ethnicities in their country of origin. Age -among the other student demographics- has also been considered in many of the existing literature in this research field. Colorado and Eberle

[6] claim that the younger the student, the lower the grade in a distance education course. However not all the studies confirm these findings [22].

Besides the student characteristics, student skills can play a significant role in their performance. Considering the nature of online courses, it is expected that students with computer and information literacy have a higher chance of success in a computer-based education. Miller, Ranier [15] support a significant positive relationship between the time spent on a course and student retention with the computer literacy. According to this study, giving a prior training on computer skills to students can increase the chances of success. In another study Coakley and Tyran [5] depict how automated feedbacks can significantly improve the learning performance. In addition to the computer and technology skills, strong planning and time management skills are also claimed to be among the most important skills of a successful distance learner, according to a recent study by Hong [12].

Other internal factors such as study habits or learning styles can also have an influence on student's learning performance. There is a variety of learning models in literature and even though these models differ in the identified characteristics, all of them agree that a learner has particular preference for learning.

Hernandez [11] and Chandler [3] chose the Kolb model to study the relationship between the learning style and completion of distance education, whereas VAK (visual, auditory, and kinaesthetic) learning styles were addressed by Pinchot and Paultet [17] in distance education. According to Williams [23], despite the disagreements about a direct correlation between student success and learning styles, there is an agreement on the link between student satisfaction of a distance education course and learning styles [13].

### 3 Introducing the case study

The research presented in this study is the first step towards a multi-step project aiming at the design and implementation of an E-learning mode of an already running face-to-face course at ITC. During this first step a diagnostic test is being developed for potential E-learning students which will help them decide on their preferred mode of education. Based on their test results and the received feedback, they will be able to make an informed decision about taking the course in proper mode.

In order to discover the most important success factors among students of our target course, we have prepared a set of questionnaires based on the existing literature and personal experience with former students of this course.

The analysis of the test results in relation with student grades in the course will be used for formulating an enhanced questionnaire containing the most effective elements.

Two groups of students from face-to-face and distance courses of Geoinformation science (GIS) and earth observation were selected to participate in the study.

#### 3.1 Setup of the questionnaires

Student characteristics, skills and learning styles are taken into consideration for preparing the tests. In addition, prior practical and theoretical knowledge in the field of study are addressed in these questionnaires.

The questions are formulated as multiple choice and multiple answers. Where a grading is required for comparison, a higher score indicates a higher level of knowledge or stronger skills on the subject of discussion.

These tests are described in more detail in the following:

1. *Personal background information:* Includes questions about student's age, gender, ethnicity (country of origin), and type of funding they have for the course.

2. *Academic, Practical and Theoretical Background:* This test aims to assess how prior theoretical and practical knowledge of the subject of study (GIS and earth observation), and academic skills affect the student performance.

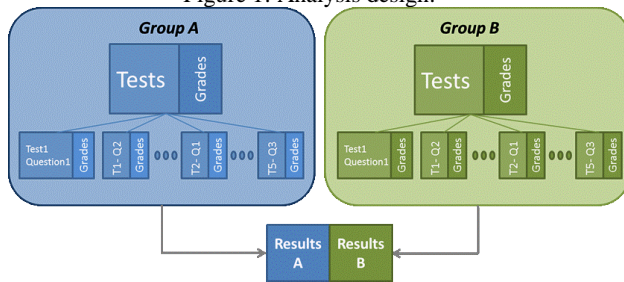
3. *Planning and time management:* Previous experience with the students suggests a higher chance of success among those who can make an efficient use of time and manage their activities carefully [16]. Similar to the previous question the answers describe characteristics, habits or preferences of a person with good time management and planning skills

4. *Reading Skills and English Language Competence:* When the student is not fluent enough in the language in which the course is offered, s/he may face more difficulties in following the course compared to a student who is highly competent in that language. The second objective of this questionnaire is to assess the reading skills. In a distance education course, most of the study material is provided as texts. Therefore having good reading skills is important for a better performance or easier adaptation with this type of education.

5. *Learning style:* Students differ in their learning style. It is questioned whether certain learning styles are more suitable for distance education than others. From the existing models of "Learning Styles" we have chosen the Felder and Silverman model (FSM) [8] as a reference for this test. This model assesses the learning preferences in four dimensions. These four are defined as: "Active or Reflective", "Visual or Verbal", "Global or Sequential" and "Sensing or Intuitive" learners. There are parallels for each of these four dimensions in other learning style models (e.g. Kolb's learning style model and the modality theory) but the unique combination of them in FSM is more suited to study for the purpose of our research. For instance, we may expect the visual learners to have a higher chance of success in a distance course compared to verbal ones who would benefit more from attending lectures and listening to the presentations in a traditional classroom environment. Or considering that the learner has to be more independent in a distance course, we may expect a reflective learner to perform better. Upon completion of this test, students will find out their learning style by using the Index of Learning Style (ILS) instrument provided on the author's website.<sup>1</sup>

<sup>1</sup> <http://www.engr.ncsu.edu/learningstyles/ilsweb.html>

Figure 1: Analysis design.



### 3.2 Selection of the test groups

Two groups of students were selected to participate in the data collection (see Figure 1).

The first group of students (Group A) is enrolled in the Geographic Information Management and Applications GIMA course which is a blended learning MSc course offered by ITC in collaboration with three other universities in the Netherlands. In 2014 this group had 22 students (5 females, 17 males, from The Netherlands and other European countries) who participated in the test and 21 of them completed all questionnaires.

The second group of students (Group B) are ITC students of the academic year 2014 who have participated in the “Core Module” in face-to-face mode at the beginning of their studies. The Core module is a combination of three modules: GIS, Earth Observation, Integration and perspective; each consisting of practical and theoretical components. The module grades and the overall core module grade is considered for the analysis to validate the existing theories, test our assumptions or to find new correlations. 129 students from the core module 2014-2015 (40 females, 83 males, from 33 different countries, ages between 20 and 35) participated in the study.

Each group was analysed separately to determine the influence of various factors on student performance. Later the results from the two groups were compared to discover the similarities and differences between them.

The preliminary results and conducted analysis are presented in the following section.

## 4 Analysis design and future work

Preliminary analysis of the data indicates a correlation between the final grades and the following factors: age, country (grouped into regions of Latin America and the Caribbean, North America and Europe, Africa, Arab states, Asia and the Pacific, based on UNESCO education regions), academic skills, and both theoretical and practical background on the topic of study.

Simple distribution statistics also show that the majority of students in this course are active, visual, sequential and sensing learners (presented in Table 1 and Table 2). The results of this test in relation to the final module grades are presented in Table 3. It is evident from these results that in both groups, the verbal and global learners performed better on average compared to visual and sequential learners. And being either sensing or intuitive did not have a clear effect on the performance, whereas being active or reflective had different effects on

different education modes. Active students in the distance education (Group A) scored higher than the reflective ones, while in the face-to-face mode (Group B) reflective learners had better grades.

Table 1: Group A, test 5 results.

Learning Style		Distribution (%)		Naturally Balanced (%)
Active	Reflective	57	33	10
Visual	Verbal	80	5	15
Sensing	Intuitive	38	57	5
Global	Sequential	44	28	28

Table 2: Group B, test 5 results.

Learning Style		Distribution (%)		Naturally Balanced (%)
Active	Reflective	48	14	38
Visual	Verbal	44	13	43
Sensing	Intuitive	44	27	29
Global	Sequential	44	23	33

Table 3: Test 5 results and grade averages.

Learning Style		Group A, Average Marks(/100)		Group B, Average Marks(/100)	
Active	Reflective	69	64	66	74
Visual	Verbal	64	81	65	74
Sensing	Intuitive	63	63	68	68
Global	Sequential	67	64	71	66

In both Group A and B, the reading skills and English language competency show a clear impact on the extremes. Very strong reading skills and high English scores have a positive correlation with very high final grades.

Prior practical and theoretical knowledge in GIS were both found to be positively correlated with the scores in practical assignments and exam marks respectively. But this was not the case for academic skills.

As for computer literacy, members of Group A have all indicated a very high level of competence in computer skills, choosing the exact same answer; therefore no comparison was possible. Where for Group B, 50 students who indicated having strong computer skills, scored on average 6 points higher than 37 students with weaker computer skills.

## 5 Discussion

On the one hand the results of the current experiment cannot provide a final answer to the study question and more iteration and distance course students filling in the online test are required for obtaining more accurate and reliable results. We are not yet able to offer the most reliable and valid instrument with the current data in hand. On the other hand, as a pre-phase test, we can estimate which questions are more relevant and are of a greater importance.

Another point of discussion is on deciding how to combine the results of content related success factors (such as theoretical background in the field of study) and distance education

success factors (such as computer literacy and time management) and come up with a final success rate.

Since the group sizes are very different, it was not yet feasible to analyse the results of the two test groups in the same manner. The study was repeated on two new groups of students in study year 2015-2016. With the increased population of distance learners it will be possible to determine the influence of various factors on student success in face-to-face vs. distance education by analysing the results of each group individually and comparing the final conclusions with each other.

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