2008-01-01

Learning styles of first year Level 7 electrical and mechanical engineering students at DIT

Aidan O'Dwyer
Technological University Dublin, aidan.odwyer@tudublin.ie

Recommended Citation

O'Dwyer, Aidan : Learning styles of first year Level 7 electrical and mechanical engineering students at DIT. Proceedings of the International Symposium for Engineering Education ISEE-08, pp. 69-74, Dublin City University. doi:10.21427/b923-hd87

LEARNING STYLES OF FIRST YEAR LEVEL 7 ELECTRICAL AND MECHANICAL ENGINEERING STUDENTS AT DIT

Aidan O'Dwyer,
School of Electrical Engineering Systems, DIT, Kevin St., Dublin 8.
aidan.odwyer@dit.ie

ABSTRACT
This paper investigates the learning styles of first year, Level 7, mechanical and electrical engineering students at DIT, using the index of learning styles survey as developed by Felder and Soloman [1]. Student learning styles on these programmes are compared with the results from other such surveys. The correlation between student performance and their individual learning styles is examined in outline. Knowledge of the strongly visual learning style of these cohorts of students may be used to improve the learning environment.

INTRODUCTION
In a seminal paper, Felder [2] suggested that engineering students (in particular) have four dimensions to their learning styles. Each of the dimensions is described in opposite terms (active versus reflective, sensing versus intuitive, visual versus verbal and sequential versus global). In summary, active learners learn by trying things out or working with others, while reflective learners learn by thinking things through or working alone; sensing learners are oriented towards facts and procedures, while intuitive learners are oriented towards theories; visual learners prefer visual representation of presented material, while verbal learners prefer written or spoken explanations; sequential learners learn in incremental steps, while global learners are systems thinkers who learn in large leaps. Felder measures student learning styles by means of an Index of Learning Styles (ILS) on-line survey [1], composed of 44 multiple-choice questions, with two possible answers for each question. In a series of papers, Felder and co-workers (e.g. [3]-[5]) suggested that most engineering students are active, sensing, visual and sequential learners.

A considerable number of studies have been preformed using the ILS questionnaire, both in Ireland (e.g. [6]-[9]) and internationally (e.g. [5], [10]-[12]). This paper will focus on the learning styles of first year Level 7 engineering students and will examine, in outline, the correlation between first year engineering student performance and their individual learning styles. Broadly similar work has previously been done at IT Tallaght [7].

The two Level 7 student cohorts surveyed, in the 2007-8 academic year, were from the DT009/DT016 electrical engineering Level 7 programme and the DT006 mechanical engineering Level 7 programme. In both cases, the on-line ILS survey form was printed out, distributed to the students for completion in week 1 of the course and the survey results were collated by the author. A summary of the results, with explanations, and how the average results would inform the author's subject teaching in the semester was provided to the students in week 2 of the course; in addition, each student received their own individual survey result. Of the 41 DT009/DT016 class group, 35 completed the survey form; of the 47 DT006 class group, 35 also completed the survey form, giving an overall response rate of 80%. It should be mentioned that student participation was voluntary, with no student exposure to any risks or reprisals for refusing to participate (as in the study performed by Zywno [12]).

ANALYSIS

The data was analysed and the learning style preferences (in percentages) are recorded in Table 1 for the two student cohorts surveyed. Table 1 also shows data from comparable student cohorts. The table structure is similar to that used in a table by Felder and Spurlin [5], with *A*, *S*, *Vs*, *Sq* and *N* standing for Active, Sensing, Visual, Sequential and Number (of students), respectively. Thus, for example, of the 35 DT009/DT016 students who completed the survey, 69% were classed as active learners (and by implication 31% were classed as reflective learners), 77% were sensing learners (so that 23% were intuitive learners), and so on.

Table 1: Reported learning style preference in percentages (following Felder and Spurlin, 2005)

Sampled Population	A	S	Vs	Sq	N
DT009/DT016, Level 7, Year 1, 2007-8	69%	77%	94%	71%	35
DT006, Level 7, Year 1, 2007-8	66%	57%	97%	60%	35
IT Tallaght, Level 7, Year 1 [7], 2002-3	81%	63%	85%	29%	-
IT Tallaght, Level 7, Year 1 [7], 2003-4	78%	52%	88%	26%	-
IT Tallaght, Level 7, Year 1 [7], 2004-5	69%	67%	76%	37%	-
Second Level Students. Mean age 16.4. Studying Engineering for the Leaving Cert [6].	70%	79%	91%	58%	163

The DIT student cohort results, as revealed by this table in broad terms, are clearly compatible with other such results and with Felder's conclusions, mentioned previously, that most engineering students are sensing, visual, active and sequential learners.

More detailed analysis of the data is shown in Figures 1 to 4, in which strengths of the reported preferences are indicated. Having completed the survey, each learner is assigned a point on the scale from –11 to +11 for a given dimension. For example, in the active-reflective dimension, a learner scoring –11 is a strongly active learner, with a learner scoring –1 being a marginally active learner. Clearly, a large percentage of students have no significant preferences, except for the Visual-Verbal category, for which a large majority of students have a moderate or strong preference for visual learning. Particularly interestingly, the majority of students show no strong preference for active learning; traditionally, Level 7 programmes place particular stress on active learning in laboratories and workshops.

Figure 1: Active versus reflective learners – DT009/016, DT006 Year 1 students

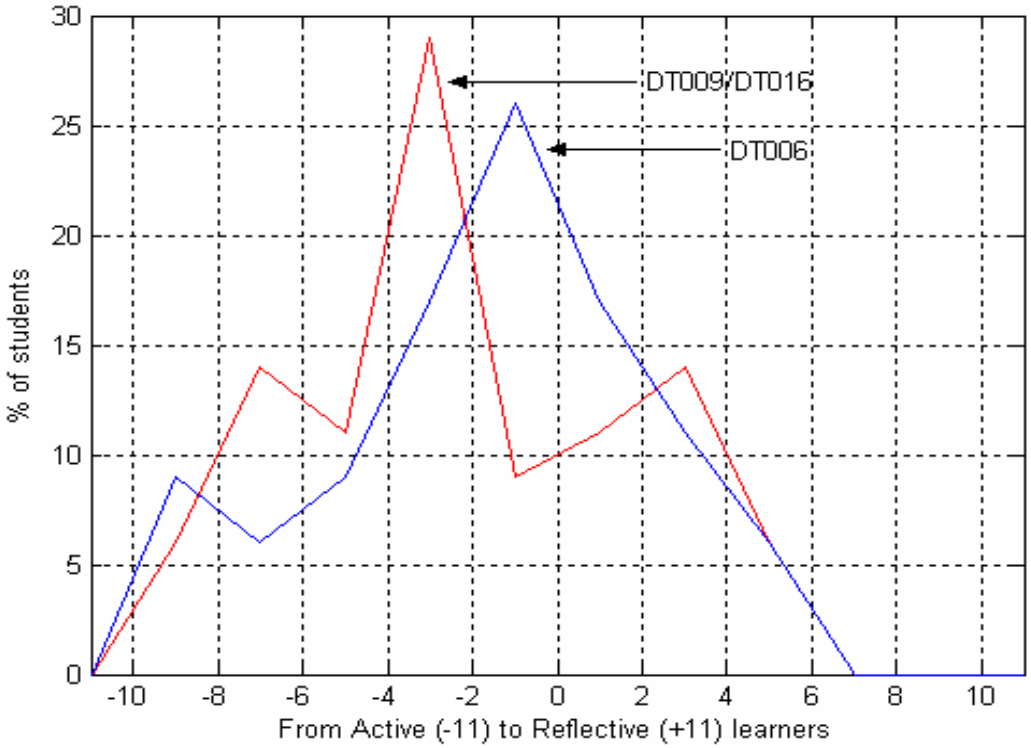


Figure 2: Sensory versus intuitive learners – DT009/016, DT006 Year 1 students

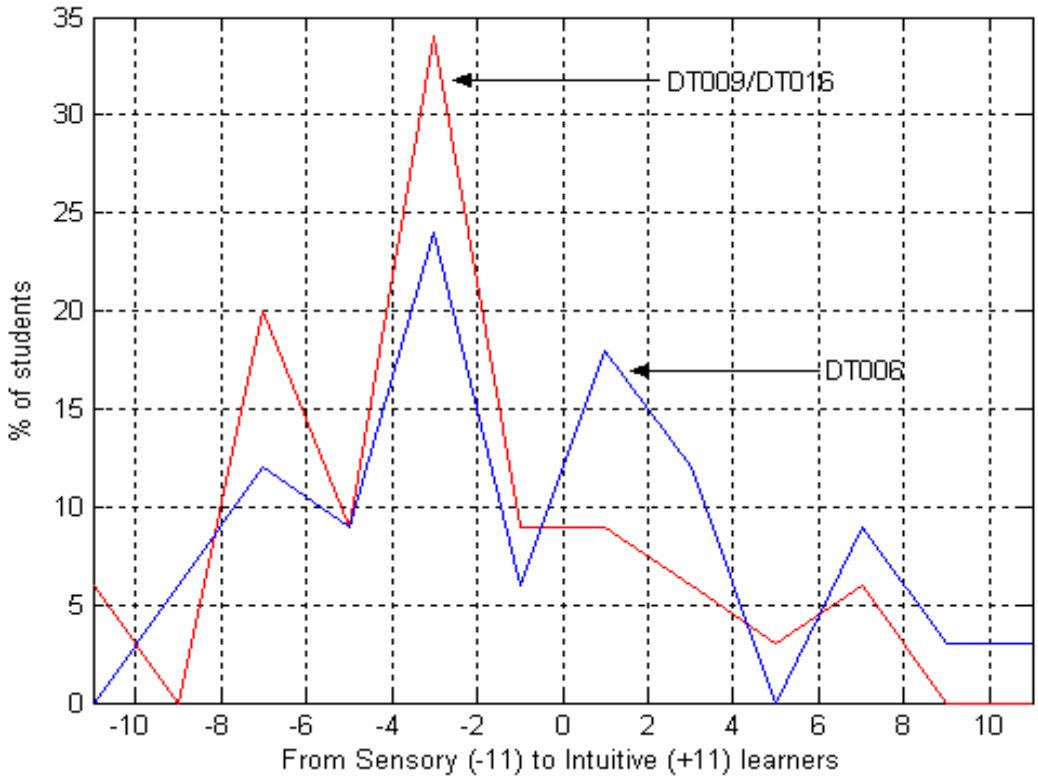


Figure 3: Visual versus verbal learners – DT009/016, DT006 Year 1 students

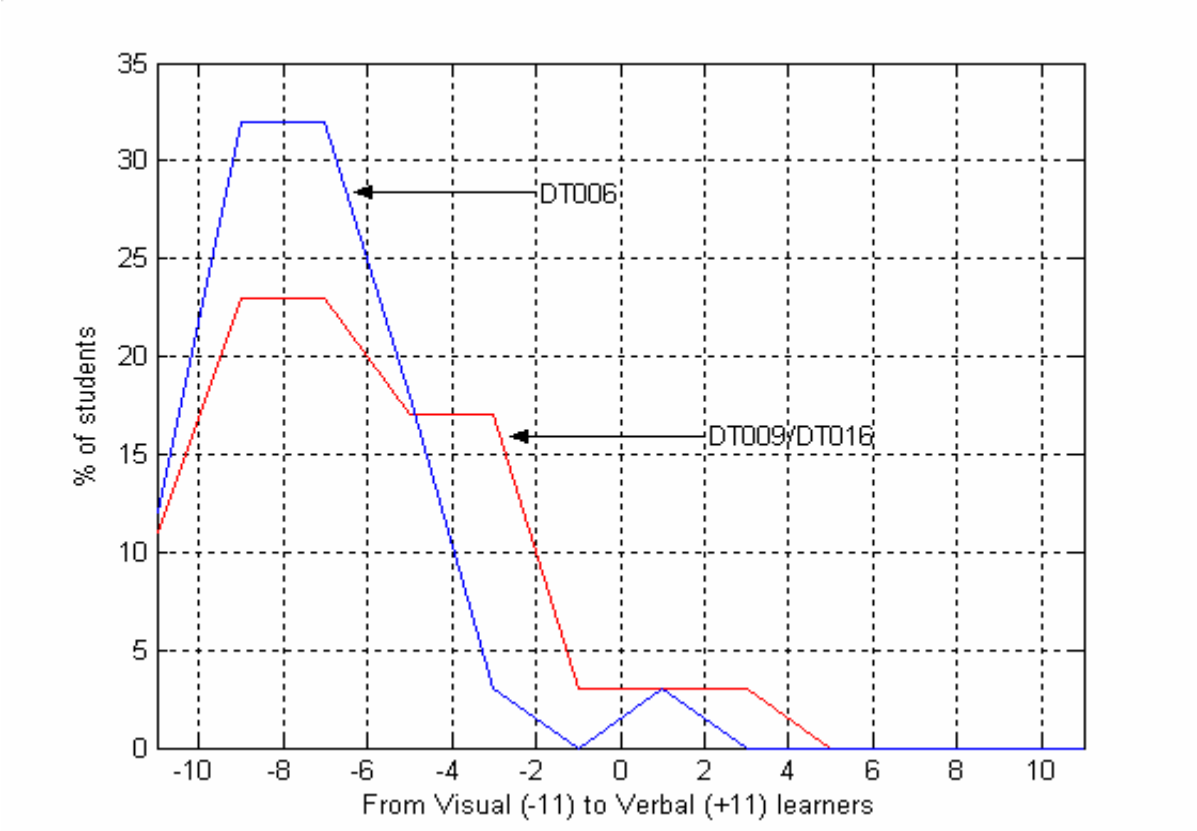
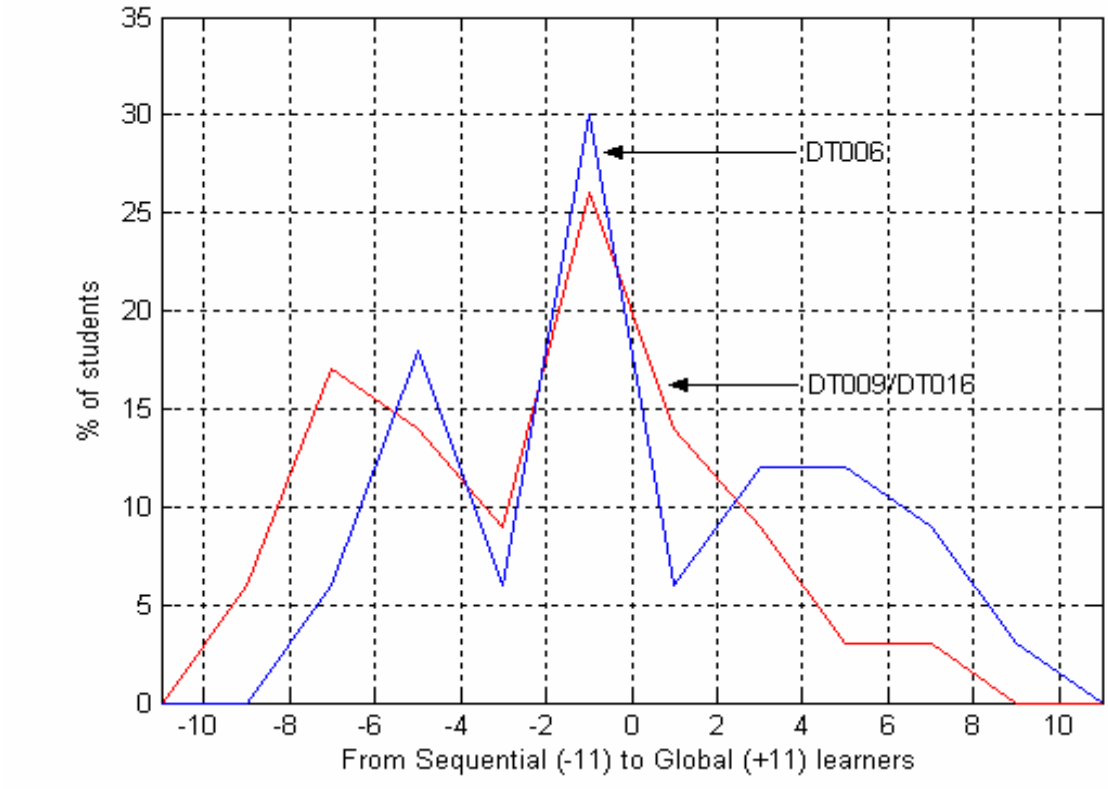


Figure 4: Sequential versus global learners – DT009/016, DT006 Year 1 students



CORRELATION BETWEEN STUDENT PERFORMANCE AND INDIVIDUAL LEARNING STYLE

At the time of writing, only outline results can be reported, as full assessment results for the academic year are not yet available. Results are reported for the Electrical Systems subject on the DT009/DT016 programme, for which the author has academic responsibility. This subject, in common with many first-year subjects in programmes with Level 7 awards, is knowledge or fact-based. It is a central technical subject in the programme, and learning in the subject is progressed further in the remaining two years of the programme. The subject is divided into two thirteen-week modules; in each module, students attend two hours of lectures and two hours of laboratories in the subject each week. The subject is assessed in the following manner:

- Terminal examination (50% of subject mark), held after the completion of the second module. This examination has a compulsory question and five other questions, three of which are to be attempted. Two of these five questions are in multiple-choice format.
- Laboratory work (25% of the subject mark); this is assessed continuously.
- Individual student project work (12.5% of the subject mark), assessed halfway through the second module.
- Module 1 assessment (12.5% of the subject mark); in 2006-7, this was an exclusively multiple-choice examination, held after the completion of the first module.

The results of the ILS survey informed instruction in the subject in the 2007-8 academic year. Lecturing was done using PowerPoint, with extensive visual material employed. Lectures are also made available on the WebCT online environment. This is partly because attendance at lectures is unsatisfactory; in addition, the subject was followed by a significant number of part-time students. Active learning in the lecture environment was prioritised, with approximately 35% of the lecture time devoted to student problem solving exercises, with the aim of increasing the depth of knowledge of the material. In addition, the module 1 assessment and the terminal examination were changed to incorporate more visual components in the questions.

Of the twenty-seven students whose assessment results may be directly correlated to their ILS survey results, 5 did not pass the examination; 3 of these had a –11 or –9 preference for visual learning. Sixteen students did not pass the module 1 assessment; 7 had a –11 or –9 preference for visual learning, and 2 more had a –11 preference for sensing learning. Six students dropped out during the year; 2 of these students had a –11 or –9 preference for visual learning, and 1 more had a –11 preference for sensing learning. Generally, students who preformed well on all aspects of the assessment have no strong preferences for a particular type of learning, though there are individual exceptions. It is important to report that the changes to lecturing method and assessment mentioned, as a result of the ILS survey data gathered, has helped to increase the overall student success rate after the first-sitting assessments are completed from 52% in the 2006-7 academic year to 68% in the 2007-8 academic year.

CONCLUSIONS AND FUTURE WORK

The index of learning styles survey is a useful tool to identify the most preferred student learning mode, for both student and lecturer. It provides rapid feedback and allows the lecturer to tailor, to some extent, both teaching techniques and assessments to the clear visual learning preference that is evident from the survey results. Such tailoring allows improvement in the student retention rate. In future work, the author will evaluate more completely the relationship between assessment results and student learning style. Even on the basis of the outline work, it is clear

that students at risk of not progressing in their programme tend to have an extreme learning style preference; the identification of such students at the start of their college career allows focused intervention to be considered. It would be desirable to create an overall learning environment across all subjects to appeal to as wide a range of learning styles as possible.

REFERENCES

1. Felder, R.M. and Soloman, B.A. (1991). Index of learning styles questionnaire, http://www.engr.ncsu.edu/learningstyles/ilsweb.html.
2. Felder, R.M., *Engineering Education*, 1988, Vol. 78, No. 7, p.674-681.
3. Felder, R.M., *Journal of Engineering Education*, 1995, Vol. 84, No. 4, p.361-367.
4. Felder, R.M., Felder, G.N. and Dietz, E.J., *Journal of Engineering Education*, 1998, Vol. 87, No. 4, p.469-480.
5. Felder, R.M. and Spurlin, J., *International Journal of Engineering Education*, 2005, Vol. 21, No. 1, p.103-112.
6. Seery, N., Gaughran, W.F. and Waldmann, T., Multi-model learning in engineering education, *Proceedings of the Annual ASEE Conference*, 2003.
7. Cranley, F. and O'Sullivan, C., *Proceedings of the International Manufacturing Conference*, 2005, ITT Dublin, p.327-337.
8. Byrne, E.P., *Proceedings of the International Symposium on Engineering Education*, 2007, DCU, p.167-172.
9. Ni She, C. and Looney, L., *Proceedings of the International Symposium on Engineering Education*, 2007, DCU, p.173-178.
10. Montgomery, S., Addressing diverse learning styles through the use of multimedia: material and energy balance, *Proceedings of the 25th ASEE/IEEE Frontiers in Education Conference*, 1995.
11. Rosati, P., Specific differences and similarities in the learning preferences of engineering students, *Proceedings of the 29th ASEE/IEEE Frontiers in Education Conference*, 1999.
12. Zywno, M.S., Instructional technology, learning styles and academic achievement, *Proceedings of the Annual ASEE Conference*, 2002.