Research Article

Differences in Student Engagement: Investigating the Role of the Dominant Cognitive Processes Preferred by Engineering and Education Students

Ian Ball and Chris Perry

Faculty of Arts and Education, Deakin University, 221 Burwood Highway, Burwood, Victoria 3125, Australia

Correspondence should be addressed to Chris Perry, chris.perry@deakin.edu.au

This paper reports on a study of the differences in the dominant cognitive processes preferred by groups of engineering and education students and examines the implications of these differences for the assessment of student engagement with university courses. Concern is expressed that the items commonly used to capture student engagement data do not adequately cover the full range of the dominant cognitive processes preferred by tertiary students. The paper sets out a brief overview of student engagement along with the theory of dominant and auxiliary cognitive processes, as developed by Jung and later by Myers. Evidence is presented of the differing frequencies of the eight cognitive processes, as assessed by the Myers-Briggs Type Indicator, that are preferred by cohorts of students undertaking courses in engineering and education. The implications of these differences are discussed in the context of subject disciplines in university environments.

1. Discussion

1.1. Student Engagement. Research in education has progressively moved from focusing on the content of knowledge (the "what"), to now encompass an examination on the process of knowledge (the "how"), such that the "current goals for learning go beyond the basics and disciplinary knowledge to include the strategies, capacities, qualities, characteristics and values needed for successful living in the modern world" [1].

Opportunities taken up at universities for participation in educationally purposeful activities are seen to influence the outcomes of student learning and achievement. Student engagement has become a concept of interest to those working in higher education, specifically those in universities as engagement serves as an indicator of successful learning and as an outcome of effective teaching [2]. Universities as institutions have become concerned about the level of engagement displayed by their students. Thus student engagement is increasingly understood to be an important aspect of quality in higher education. One common perspective in the research on student achievement is to identify the qualities shown by students that are conducive to engagement with

learning. Kuh [3] asserts that "engagement tends to have conditional effects, with students with certain characteristics benefiting from some type of activities more so than other students." Engagement relates to all aspects of a student's involvement in a course, both formal and informal elements of the curriculum. For this study, engagement is defined as "students' involvement with activities and conditions likely to generate high quality learning" [4]. Thus engagement is believed to occur when students make an investment in learning. Energy in action brings about a connection between person and activity.

Fredericks et al. [5] argue that "engagement has considerable potential as a multidimensional construct ... and can be thought of as a "meta" construct". Their approach to this multifaceted nature of engagement distinguishes between three characteristics: *behavioral engagement*—the idea of participation and involvement in activities, *emotional engagement*—encompassing both positive and negative reactions influencing willingness to work, and *cognitive engagement*—the idea of the investment of effort to comprehend complex ideas and difficult skills. These authors are concerned with school issues such as low achievement,

student boredom and disaffection, and high drop out rates. Although their literature survey and ideas focus on school settings, their conceptions appear to be relevant to university students.

For this paper, we make clear that in discussing the literature on student engagement, we are focusing on a psychological approach to the issue. Others, such as Munns and Martin [6] have claimed that any psychological approach fails to take account of the wider dimensions of social power, but they have also suggested that any sociological approach also fails to fully understand the complexity of the individual. Thus our intent is not to provide an amalgam of various approaches as those authors have done, but to investigate whether psychological-type concepts can contribute to explanations of differences found in levels of student engagement at university. We note that the model developed by Munns and Martin fails to indicate any role for personality differences (type or trait). Although it does delineate what are described as adaptive and impeding cognitive dimensions, we note that these dimensions are framed in terms of motivation not personality.

1.2. Measuring Student Engagement. Kezar and Kinzie [7] have found, through multisite case studies, that tertiary institutions show distinctive approaches to creating an engaging environment for their students. Studies in the USA using the National Survey of Student Engagement (NSSE) support these findings (see, e.g., Kuh [8]). Kuh reports that student engagement represents the amount of time and effort students put into their study and how institutions deploy resources and curriculum. A series of five benchmarks have been established for student engagement. These are active and collaborative learning (i.e., the focus of this study), academic challenge, student interactions with faculty, enriching educational experiences, and supportive campus environment [8].

A central theme in describing student engagement is the extent to which students are involved in active learning. Active learning is thought to be facilitated by students' participation in experiences that involve constructing new knowledge and understanding [9]. Kuh [8] describes active and collaborative learning as means by which students learn more because they are intensely involved in their education and are asked to think about their work and apply what they are learning in different settings.

In Australia, the Federal Government currently requires all accredited providers of higher education to participate in, and report on, an annual survey of student engagement. The Australasian Survey of Student Engagement (AUSSE), managed by the Australian Council for Educational Research (ACER) defines engagement as students' involvement in activities and conditions that are linked with high quality learning [4]. The AUSSE measures student engagement by providing information about the level of students' use of the educational opportunities available and to what extent the students are actively involved in their learning. There are strong similarities between the NSSE used in the USA and the AUSSE used in Australia and New Zealand.
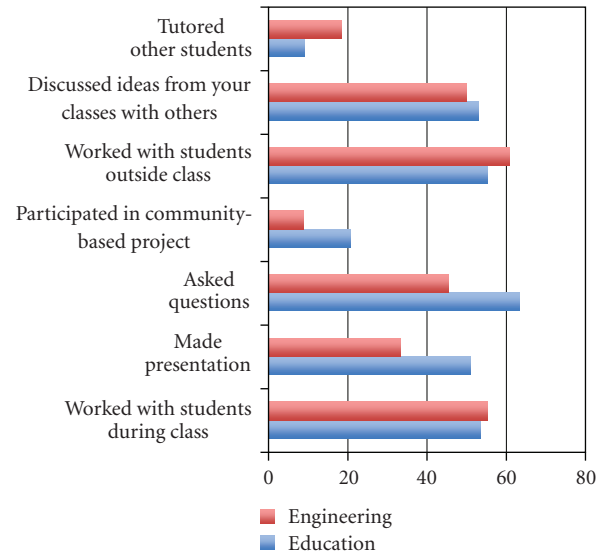

FIGURE 1: Observed differences in active learning engagement items between Engineering and Education students in Australian Universities [10].

1.3. Student Engagement and Two Different Fields of Study. Researchers of data on student engagement have noted that there are often greater differences between students in different fields of study within institutions than between students across different institutions (ACER, personal communication). In the following section, we present one of the sets of results of the AUSSE instrument from all Australian institutions for 2009 for two different fields of study (the psychometrics of the AUSSE is outside the scope of this present study; however, full details of administration, purposes, validity and reliability of the instrument can be accessed by the website http://ausse.acer.edu.au/).

These fields were Engineering and Education and were chosen for reasons of their fairly high frequencies and because they are often considered to be contrasting in the types of students undertaking studies in these fields. These fields represent different proportions of gender. Also significant is the contrasting nature of the studies involved with varying proportions of studies focussing on working with people versus working with materials. Much of the existing literature illustrates that the learning culture and practices within these two fields of study favour different cognitive processes.

Figure 1 presents a comparison of the item scores for the active learning engagement scale for Engineering and Education students.

The AUSSE active learning items are scored on a 0–100 metric, and the results shown in Figure 1 indicate that the engagement of students in these two fields of study vary considerably across these activities. Education students have higher scores for asking questions and making presentations in class compared with Engineering students. Engineering students seem more likely to have experiences in tutoring other students and working with other students outside class. It can also be observed that across the two fields of study

the different activities have varying likelihoods of being experienced in their programs, for example, the two fields of study differ in the likelihood of participating in community-based programs, but do not vary much in opportunities provided for discussing ideas from their courses with others, which is a much more frequent activity.

One issue that is relatively unexplored is the role that a student's dominant cognitive processes might play in their engagement with their studies. It may be that particular processes are more conducive to engagement than others, and that students undertaking studies in different disciplines may display differences in their use of dominant cognitive processes.

1.4. Cognitive Processes. Felder and Brent [11] argue that: "students have different levels of motivation, different attitudes about teaching and learning, and different responses to specific classroom environments and instructional practices. The more thoroughly instructors understand the differences, the better chance they have of meeting the diverse learning needs of all of their students". Thus further research about student engagement would seem to profit from exploring the "diverse learning needs" of university students.

There is some recent literature about the role of differences in psychological type as it refers to learning in higher education including aspects such as choice of major study, academic achievement, and preferences for teaching modalities. DiRienzo et al. [12] report on a range of relationships between personality types, choice of major study, and academic achievement. Their results show that different types are drawn to a particular academic area, but do not necessarily perform better than other types. In research on personality types conducted by Swope and Schmitt [13] and Tharp [14], judging types generally have higher average Grade Point Averages (GPAs) whereas perceiving types have lower average GPAs.

Harrington and Loffredo [15] found clear evidence that students with extraversion preferences related better to face-to-face delivery compared with students with introversion preferences, concluding that psychological type plays a significant role in preference for online versus face-to-face instruction.

These findings give some credence to the relevance of psychological-type concepts to learning in higher education; although they explore relationships between the types identified by the Myers-Briggs Type Indicator (MBTI), they do not explore the differences of the cognitive processes preferred by particular types. Each type has a distinctive pattern of preferences—for what energises: interaction with others (Extraversion) or more solitary activities (Introversion)— for what is accessed in information gathering: tangible, experiential awareness (Sensing) or conceptual, symbolic awareness (Intuiting)—the process of organising, evaluating and deciding on information: based on criteria or principles (Thinking) or based on appropriateness of worth (Feeling). Each of the possible combinations of these dichotomies leads to differences in cognitive processes.

It is believed that clear differences exist in students' preferences for cognitive processes and a study of these may aid better understanding of individual differences. Understanding engagement through active or self-regulated involvement in learning, described by Sharan and Geok Chin Tan [2] as cognitive engagement, requires that we have an understanding of the cognitive processes involved in active learning (Pintrich [16]; Schunk [17]).

1.5. Explaining the Dominant Cognitive Processes. The eight cognitive processes discussed here fall into two groups: the ways that we use to focus attention and gather information, we use these to perceive people, ideas, and things (Perception) and the ways that we use to organise our experiences and make decisions, the ways we make judgments about people, ideas, and things (Judgment).

Jung [18] first described these eight processes in his book, Psychological Types. The eight processes have sometimes been called "the eight-functions model" [19], "the mental functions", "the functions-in-attitude", or "the attitude functions" [20].

The Perception processes differ in focus. Jung recognised four types of perceived data. These are the way things are, the way they used to be, the way they could be now, and the way they will ultimately be.

1.5.1. The Four Perception Processes. These four ways are those we use to focus attention and gather information: Extraverted Sensing (Se), Introverted Sensing (Si), Extraverted Intuiting (Ne), and Introverted Intuiting (Ni).

Once we have perceived something, we either have to organise or integrate any new idea with the other data we have perceived or we will forget it. Jung called the four processes we use to organise the data and make decisions about the data—the Judgment functions.

1.5.2. The Four Judgment Processes. These four ways are those we use to organise experiences and make decisions: Extraverted Thinking (Te), Introverted Thinking (Ti), Extraverted Feeling (Fe), and Introverted Feeling (Fi).

All eight of the cognitive processes are available to us but just like the preference for either right or left hand, some are more developed and accessible than others. Jung's theory outlines the dominant process as the one that we are most comfortable to use and trust, and that operates almost like an automatic pilot.

In the theory, the relationship between the dominant and auxiliary is tied up in the process of development as one takes in information and the other makes decisions. Haas and Hunziker [21] maintain that "the auxiliary supplies much of the balance that we need as we move through life... The auxiliary complements the dominant process". "Jung observed that the psyche has a need to balance the purpose and orientation of the dominant process, for example, a dominant Judging process needs to be balanced by a Perceiving process, and the dominant orientation of the extraverting one balanced by an introverting one" [22]. Further information about how these processes are derived from measures of psychological type such as the Myers-Briggs Type Indicator (MBTI) is contained in the Appendix.

1.6. Describing the Cognitive Processes. Drawing on the theory of cognitive processes as developed by Jung and later by Myers [23], researchers such as G. Hartzler and M. Hartzler [24], McGuiness [25], Berens and Nardi [26], and Haas and Hunziker [27] have produced a series of varying descriptions of the eight cognitive processes. For this study, we produced a synthesis of the key defining characteristics to clarify the differences between each of the eight cognitive processes. These characteristics are briefly characterised as follows.

1.6.1. The Dominant Perception Processes

Extraverted Sensing (Se). Extraverted Sensing occurs when we become aware of what is in the physical world in rich detail. In this process, one responds naturally to everything tangible that is detected through all of the five senses. Extraverted Sensing is operating whilst immersed in the present context.

Introverted Sensing (Si). The process of Introverted Sensing permits the amassing of huge amounts of sensory data and also stores our personal reactions to the data. Using this process we compare present reality to the stored impression from the past, recalling how things were in detail along with their internal reactions to the thing or event.

Extraverted Intuiting (Ne). The external stimulus triggers the imagination to enable one to see many new and different possibilities. Extraverted Intuition finds substantive connections and energising patterns and relationships between objects, people, and events in the environment.

Introverted Intuiting (Ni). The process of Introverted Intuiting enables one to simultaneously see ideas from several perspectives, synthesising the seemingly paradoxical or contradictory, which takes understanding to a new level. This process can involve working out complex concepts or systems of thinking or conceiving of symbolic or novel ways to understand things that are universal.

1.6.2. The Dominant Judgment Processes

Extraverted Thinking (Te). Empirical thinking is at the core of Extraverted Thinking when we challenge someone's ideas based on the logic of the facts in front of us or lay out reasonable explanations for decisions or conclusions made, often trying to establish order in someone else's thought process. In written or verbal communication, Extraverted Thinking helps us easily follow someone else's logic, sequence, or organisation.

Introverted Thinking (Ti). Introverted Thinking is like having an internal sense of the essential qualities of something, noticing the fine distinctions that make it what it is and then naming it. It also involves an internal reasoning process of deriving subcategories of classes and subprinciples of general principles. These can then be used in problem solving, analysis, and refining of a product or an idea.

Extraverted Feeling (Fe). Extraverted Feeling involves building trust through building relationships. The aim is to harmonise the group and has an outward focus on the needs, desires, and values of others.

Introverted Feeling (Fi). The Introverted Feeling aims to stay true to who they really are, and makes value-based decisions to maintain personal integrity. As a cognitive process, Introverted Feeling often serves as a filter for information that matches what is valued, wanted, or worth believing in. There can be a continual weighing of the situational worth or importance of everything and a patient balancing of the core issues of peace and conflict in life's situations.

1.7. The Possible Linkages between the Eight Cognitive Processes and Measures of Active Learning. For this study, we first established if the eight cognitive processes could be linked to the seven areas of active learning activities investigated by the AUSSE instrument for measuring student cognitive engagement. In this section, we report on our efforts to ascertain if possible relationships exist and their likely forms.

As already noted, we undertook this analysis because one issue that is relatively unexplored is the role that dominant cognitive processes might play in student engagement. It is possible that particular processes are more conducive to engagement than others, and that students undertaking studies in different disciplines might display differences in their use of dominant cognitive processes and hence differ in their levels of engagement. For example, the activity of making a presentation can certainly involve all aspects of engagement: behavioural, emotional, and cognitive. Our argument is that this activity (and others) will be approached differently by students with varying dominant cognitive processes. A student operating on Extraverted Feeling (Fe) making a presentation would be likely to attempt to involve other participants in discussion of ideas, looking for personal meanings and seeking harmony in the group. Whereas a student operating in Introverted Thinking (Ti) would be likely to stress the problematic state of the ideas, and focus on their logical structure probably without any personal references. This pair of presentations would be perceived as quite different interpretations of the activity by observers. Both students could indicate high engagement in the activity, but the processes in operation would be distinctly different.

The AUSSE instrument identifies active learning through seven items. These items can be summarised as follows: discussing ideas from your classes with others, participating in community, tutoring other students, working with students outside class, working with students during class, making presentations, and, asking questions.

We called on the expertise of three educators with both long experience in education at a variety of levels, and a detailed understanding of the synthesis of cognitive processes and asked them to carefully examine the AUSSE active learning items and determine the extent to which each of

the AUSSE activities reflects the use of particular cognitive processes. Each panel member independently rated each activity as having a high, medium, or low possible relationship with each of the eight cognitive processes. Table 1 reports the average of the pooled judgments of the panel members. Very few disagreements were found.

An examination of Table 1 indicates that the Introverted Intuiting (Ni) process is only highly engaged in one of the seven activities, whereas the Extraverted Intuiting (Ne) process is highly engaged in six of the seven activities.

It would appear that students with a preference for a cognitive process that is Introverted Intuiting (Ni) would have some difficulty (unlike their colleagues with a preference for Extraverted Intuiting (Ne)), in achieving well in most of the active learning situations. This fact would have direct implications for their motivation for, and engagement with, their studies.

Table 1 also indicates that the Extraverted Feeling (Fe) process is highly engaged in five of the activities whereas the Introverted Feeling (Fi) processes are engaged at a high level in only one of the activities. This suggests that those students whose cognitive processes indicate a preference for Extraverted Feeling (Fe) would be more actively involved and thus highly engaged. The judgments recorded in Table 1 can lead to the conclusion that a student with dominant Extraverted Feeling (Fe) might be expected to find more involvement with activities where interaction with peers is a key element rather than with activities such as formal presentations and teaching tasks because their dominant process in operation draws them to focus on the needs, desires, and values of others.

Viewing the data overall indicates that 18 percent of the activities register as low for all of the cognitive processes, but 52 per cent are noted as having a high relationship with the activities. This suggests that these differences could have direct implications for measuring the strength of cognitive engagement.

Our conclusion from this preliminary investigation is that it seems likely that students preferring different dominant cognitive processes will differ in their approach to a number of the active learning activities.

1.8. Psychological-Type Explanations for Student Differences. We now turn to some evidence which tests the proposition that university students will use all of the eight processes, but in varying proportions. In view of the evidence from Figure 1, we decided to examine the distributions of the dominant cognitive processes in cohorts undertaking studies in two different faculties. It was considered likely that choice of degree emphasis may be related to the dominant cognitive processes being expressed by students undertaking courses with different planned outcomes [28].

Data from Engineering students ($n = 221$) and Education students ($n = 336$) were made available to the researchers on the basis that privacy of the students and their institutions would be respected. Both cohorts had voluntarily undertaken the Myers-Briggs Type Indicator as part of their
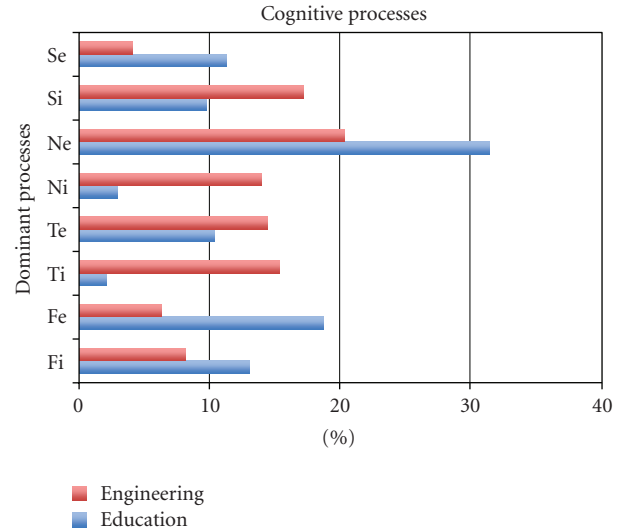

FIGURE 2: Frequencies of the dominant cognitive processes preferred by 221 Engineering students and 336 Education students.

programs. MBTI profiles were used to determine the dominant cognitive processes using the method of determining the dominant process from MBTI codes which has been detailed by Haas and Hunziker [27]; see Appendix. The two groups are not directly aligned. The Engineering students were from a select group of undergraduates with very high ENTER (tertiary entrance) scores who were undertaking leadership programs. The gender balance was approximately 71% male and 29% female, the age range was restricted to those between 18 and 20, and the MBTI data was gathered across four cohorts. The Education students represent the full range of ENTER scores for a single cohort, the gender balance was 26% males and 74% females, and the age range is more varied with majority of students (85%) in the 25 years and under age group, most about three years from leaving secondary school, but with some mature students. So although the two samples are not directly aligned they do reflect the differences between these types of courses and are useful for this sort of investigation.

Figure 2 presents an overview of the frequencies of the dominant processes in each of the student samples. Inspection of Figure 2 suggests that each of the processes occurs in each sample, and clearly the highest percentage in each group is for Extraverted Intuition (Ne). Almost one third of Education students and one quarter of Engineering students preferred this process. However, the other percentages differ markedly from sample to sample, particularly for Introverted Thinking (Ti) and Introverted Intuition (Ni).

The balance between extraverted processes and introverted processes is more evenly distributed ($P < .001$) in the Engineering sample, 45% having extraverted processes compared with 72% of Education preferring extraverted processes. The distributions across Judgment: Thinking and Feeling processes are also significantly different between the two samples ($P < .001$), with 65% of Engineering students preferring Thinking processes compared with 28% of Education students having Thinking processes preferences.

TABLE 1: Judgments by the panel of the likelihood of each cognitive process being apparent in each of the AUSSE learning activities related to student engagement.

Cognitive processes: AUSSE: Active learning activities	Se	Si	Ne	Ni	Te	Ti	Fe	Fi
Discuss ideas from your class with others	high	high	high	medium	high	medium	high	medium
Participate in community-based projects	high	medium	high	medium	high	medium	high	high
Tutored other students	low	medium	low	low	medium	high	low	medium
Worked with students outside class	medium	medium	high	low	medium	high	high	medium
Worked with students during class	medium	high	high	low	medium	high	high	low
Made presentations in class	high	medium	high	medium	high	low	low	low
Asked questions or contributed to discussions in class or online	high	high	high	high	high	high	high	medium

TABLE 2: Differences between Engineering and Education students preferring various dominant cognitive processes.

Cognitive processes	Engineering students %	Education students %
Extraverted Sensing	4.07	11.31
Introverted Sensing	17.20	9.82
Extraverted Intuition	20.36	31.53
Introverted Intuition	14.03	2.97
Extraverted Thinking	14.48	10.42
Introverted Thinking	15.39	2.08
Extraverted Feeling	6.33	18.75
Introverted Feeling	8.14	13.09

Differences across the other dichotomies are also statistically different ($P < .05$). The group type for Engineering students shows INTJ preferences, and this differs from the group type for Education students who show ENFP preferences. The only similarity is that the majority of both groups prefer Intuition (N).

A visual inspection suggests that Education students show greater variation in their dominant processes. It can be seen that Introverted Intuition and Introverted Thinking have very low frequencies compared with those of the Engineering students. The Education sample shows a higher frequency for Extraverted Feeling than does the Engineering sample.

It was considered desirable to test the statistical significance of differences between the two samples shown in Table 2.

The evidence in Table 2 provides some potentially useful information about the differences in preferences between these two samples of students. The data in Table 2 confirm that students from the two different fields of study do vary in the frequencies of their preferences across the eight cognitive processes, for example, Engineering students ranged from

20.36% to 6.33%, whereas Education students ranged from 31.53% to 2.08%. The results in Table 2 are very unlikely to have been due to chance factors alone. The Chi-square for the Table is 33.16, 7 d.f. $P < .005$, indicating that the two sets of students show statistically different percentages of the eight cognitive processes.

Implications for universities can be drawn from this data. From Table 1 it can be seen that students seem to engage with the different activities in varying ways and we believe that these ways can be compared with the differences in frequencies of the dominant cognitive processes depicted in Figure 2. The data summarized in Table 2 help to illuminate the differences between the two fields of study noted in Table 1. Differences in engagement between the two fields of study appear to be linked to the different frequencies in dominant cognitive processes.

2. Conclusion

In summary, from these data sets it is evident that university students do show the full range of the eight cognitive processes as their dominant process. This generalisation must be tempered by the fact that the distribution of these dominant processes occurs in different patterns of frequencies across the disciplines/faculty groups sampled here. Further collection of data would clarify the roles of the different disciplines taught in most universities. Our data clearly identifies Extraverted Intuition as the highest frequency in both our groups. However, the two groups show significant differences in the use of Introverted Intuition and Introverted Thinking. In these two cases, Education students did not exhibit their use of these cognitive processes to the same extent as Engineering students.

This study has illuminated a further facet to aid our understanding of individual differences as it relates to student engagement. Clearly, some particular cognitive processes are not uniformly utilised by individual students in the experiences identified as indicating active learning.

The results strongly indicate that the Extraversion-Introversion component of the cognitive processes data highlights the significance of the role played by this personality factor in student engagement. Education students and Engineering students differ strongly on this dimension.

Additionally the Thinking-Feeling dimension has utility in describing the difference between Engineering and Education students. Acknowledging these type differences must enhance our understanding of the complexity of student engagement by also including them in survey data to gather information on students' preference for various cognitive processes.

This study also makes apparent that the distributions of dominant cognitive processes share commonality and disparities across disciplines, as indicated here, the disciplines of Education and Engineering. The data presented indicates, for example, the high frequency among students in both disciplines of Extraverted Intuiting and Extraverted Thinking as well as the significant differences in the frequencies of other processes between the faculties, for example, Introverted Intuiting and Introverted Thinking. These differences and similarities probably reflect the attraction of these study areas to different types of students. More work is needed to verify this assumption.

Exploring the full set of results presented here suggests that contextual factors, particularly the choice of planned activities by university staff, may interact with the operation of dominant cognitive processes of students and perhaps limit their degree of engagement with the course. Few Engineering students seem to have Extraverted Sensing (Se) as a dominant process, yet any practical work choices made by university staff may call for the operation of this process. Such students would not be in their favoured process and are likely to experience extra demand affecting their usual effectiveness. Conversely, in Education few students have Introverted Thinking (Ti) as a dominant process so practices initiated by staff with this dominant process may not be also increase cognitive demands and lead to disengagement.

In conclusion, examination of student engagement needs to focus on the student as an individual undertaking a particular discipline study. As Kuh [29] warns, "we must be ever vigilant to be sure we are interpreting and using engagement data appropriately and continue to learn more about what forms of engagement work best under what circumstances for different groups of students". We endorse studies of student engagement that acknowledge discipline differences as well as differences in psychological type.

Appendix

Decoding the 4-Letter-Type Code to Determine which Process Is Dominant and which Is Extraverted

The break-through of Isabel Myers was her conceptualisation of the 4th letter of the type code. This was concerned with one's orientation to the environment, whether the preference

was making decisions (J) or perceiving (P). This defines the natural order of our preferences for engaging all eight of the cognitive processes and places Jung's theory into a complex system. Hass and Hunziker [30] believed that Isabel Myers formed the model of the 4th letter in type codes "because her central purpose in creating the Indicator was to provide everyone access, through interpretation, to the understanding of his or her own type".

Decoding the 4-letter-type code begins with the J-P dichotomy. This 4th letter determines the function that is extraverted. The J points to the Judging function being the preferred way of interacting with the environment that is, the 3rd letter either T or F. If the 4th letter is P then the perceiving function (2nd letter S or N) identifies the preferred function that is extraverted.

Using the balance principle, the function that is introverted can be determined, so if the 2nd letter was found to be extraverted then the 3rd letter represents the function that is introverted. Thus it can be deduced that if the function identified by the 3rd letter is extraverted then the function identified by the 2nd letter is introverted.
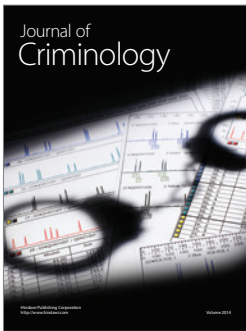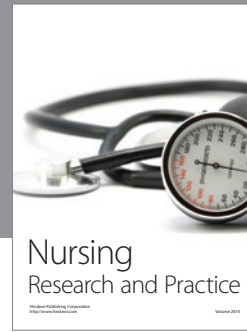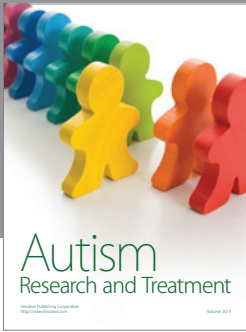
Identification of the most preferred or dominant cognitive process follows from the previous two steps. The 1st letter of the type code indicates which of the processes is dominant either the extraverted one or the introverted one. If the 1st letter is E, the dominant process will be extraverted, If I the dominant process will be introverted.

The remaining task is the determination of the auxiliary process. This simply the process not identified as the dominant one. The four steps that Myers devised assist in making a practical application of Jung's theory.

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