



Disciplinary Diversity in Chilean Undergraduate Student Engagement¹

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Abstract: There is growing interest in investigating the student experience in higher education, particularly given the considerable widening of access and, so, diversity. Chile's *Encuesta Nacional de Compromiso Estudiantil* (ENCE) has been applied since 2017 by a group

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of universities of the Council of Rectors of the Chilean Universities (CRUCh), eliciting a battery of evidence covering the student experience. This study documents current efforts to organize information about the student experience into student engagement profiles, reported here with reference to selected undergraduate disciplines. The results of ENCE 2019 are analyzed, as applied to 9869 undergraduates in their first year and in their fourth year since commencing, in nine universities. Cluster analysis of the entire sample of students in all fields, and subsets of those respondents in the fields of Civil Engineering, Law, Medicine and Teaching, yield diverse patterns of student engagement. Further consideration follows of the current and potential use of student engagement data in Chile and other countries, and the differences across different study fields and professional traditions.

Keywords: student engagement; disciplines; cluster analysis; teaching and learning; survey design

Diversidad en el compromiso estudiantil en programas de pregrado en Chile

Resumen: Ha aumentado el interés por investigar la experiencia estudiantil en educación superior, particularmente considerando el amplio crecimiento en el acceso y diversidad. En Chile, la Encuesta Nacional de Compromiso Estudiantil (ENCE) ha sido aplicada desde 2017 por un grupo de instituciones del Consejo de Rectores de las Universidades Chilenas (CRUCh), levantando una batería de evidencias relativas a la experiencia estudiantil. Este estudio documenta los actuales esfuerzos por organizar la información que reportan los estudiantes en perfiles de compromiso estudiantil a partir de ciertas áreas disciplinarias y profesionales. Los resultados de ENCE 2019 son analizados, incluyendo información de 9869 estudiantes de primero y cuarto año de programas de pregrado en nueve universidades. Se analizan diversos patrones compromiso estudiantil mediante análisis de conglomerados de la muestra completa, que incluye a estudiantes de programas de todas las áreas de estudio, y submuestras de estudiantes en programas de Ingeniería Civil, Derecho, Medicina y Educación. Se plantean diversas consideraciones sobre el uso actual y potencialidades de las evidencias generadas en Chile y otros países, y las diferencias que aparecen entre diversas áreas de estudio y tradiciones de formación profesional.

Palabras-clave: compromiso estudiantil; disciplinas; análisis de conglomerados; enseñanza y aprendizaje; diseño de encuestas

Diversidade no compromisso estudiantil em programas de graduação no Chile

Resumo: Há aumentado o interesse em investigar a experiência estudiantil no ensino superior, particularmente considerando o amplo crescimento ao acesso e diversidade. No Chile, a Pesquisa Nacional de Compromisso dos Estudantes (ENCE) tem sido aplicada desde 2017 por um grupo de instituições do Conselho de Reitores das Universidades Chilenas (CRUCh), levantando uma série de evidências relativas a experiência estudiantil. Este estudo documenta os atuais esforços para organizar a informação que reportam os estudantes em perfis de compromisso estudiantil a partir de certas disciplinas e profissões. Os resultados da ENCE 2019 são analisados, incluindo informações de 9869 alunos de graduação do primeiro ao quarto ano em nove universidades. São analisados diversos padrões do compromisso estudiantil mediante análise de agrupamento da amostra completa, que inclui estudantes de programas de todas as áreas de estudo e subamostras de estudantes de Engenharia Civil, Direito, Medicina e Educação. São levantadas diversas considerações sobre o uso atual e potencialidades das informações geradas no Chile e em

outros países, e as diferenças que aparecem em diversas áreas do estudo e tradições de formação profissional.

Palavras-chave: compromisso estudantil; disciplinas; análise de agrupamento; ensino e aprendizagem; projeto de pesquisa

Disciplinary Diversity in Chilean Undergraduate Student Engagement

This article seeks to identify patterns of student engagement within Chilean undergraduate education, which is generally structured as preparation for various professions, a configuration that predominates throughout Latin America. The study reveals not only differences between professional disciplines, but also the presence within different professional courses of distinct *clusters* of students reporting similar patterns of engagement. By understanding such clusters, it is possible to consider how student engagement might be supported in order to enhance the learning of individuals and their class cohorts. The article follows the structure of a scientific report, with an introduction (including of the survey and its analysis), a literature review, methodology, results in the form of various clusters, further discussion and conclusions. It is important to note, however, that an undercurrent throughout the article is the value of demonstrating student engagement data in ways that might inform teaching and other learning support within academic communities. The articles reports the clusters that emerge within the total sample and within each of the four most populous areas of study in the survey sample.

Not just knowledge but the capacity to learn are now more than ever recognized as crucial life skills, and areas where formal education can add value. Meanwhile, digital technologies may be learning to predict and prompt our behaviors faster than we are learning about those same technologies (Zuboff, 2019). Perhaps we can gain respite if we learn to think critically, and add value in the application of ever better algorithms and automation through so-far irreplaceably human intuition, taste, know-how and “design” (Murphy, 2015). Student engagement, including Chile’s *Encuesta Nacional de Compromiso Estudiantil* (ENCE), is certainly like that; the value of learning and getting better at learning are foundational assumptions in a logic in which higher education is held to be especially good at fostering and directing such capacities towards better preparedness for careers and life in general. As our very understanding of work is in flux, being able to apply oneself to a particular disciplinary or professional identity is, if nothing else, also some preparation for future versatility.

Few argue against the importance of learning, prompting questions as to why the student engagement perspective is a distinctive resource to support learning in higher education (Ashwin & McVitty, 2015). Measuring learning, all the more so in generic and vital skills, is not easy, and student engagement does take the indirect approach of matching what students actually do with generalized assumptions of what has been proved to foment learning. Student engagement allows for the notion that there are more and less suitable patterns and priorities in learning, evident according to whatever disciplinary preparations students are undertaking. Engagement measures are drawn from the vast canon of studies on student life and learning—certain experiences and populations evolve, survey adaptations in new places require drawing on local conditions and bodies of empirical evidence, and the retrospective establishment of validity is an important task for keeping an instrument well-tuned and methodologically transparent as educational experiences evolve (Coates & McCormick, 2014). Engaging in identifiable strategies and patterns of time use tend to reflect the broad areas of inquiry into which students might direct their energies, and areas in which academic programs might direct further efforts. This is not so much a question of generic engagement versus non-engagement or disengagement, but rather in engaging in particular practices in loose but judicious proportions.

Here, we are especially concerned with an obvious qualifier for dividing different kinds of learning—the “horizontal” diversity between broad disciplines that are clearly pronounced in a Chilean undergraduate education (and predominantly throughout Iberoamerica) formally organized around credentials in particular professions. We ask after differences and commonalities evident between disciplines, and any corollary implications for supporting learning in institutions.

The underlying idea of engagement—that what students do is more important for their learning than who they are—has perhaps become a radical holdout position (Kuh et al., 2011). At the same time, political commentary notes that human existence is increasingly catered for and marshalled according to group identities, with Chile as no exception (Peña, 2021). One way of advancing the testing of the engagement hypothesis, then, is to recognise whatever aspect of vocation that lies in students choosing their own discipline; a growing body of Chilean research grapples with the notion of cultivating professional identities (Cuadra et al., 2021), especially with regard to teaching as a profession (e.g., Jaramillo et al., 2020). The basic hypothesis here can be stated thus: that at the level of specific study fields, particular patterns of student engagement are evident, which go beyond general patterns in the student population. Without doubt different institutions face different profiles of student preparation, but the distinct teaching and support traditions of different professional disciplines make the sharing of aggregate data and good practices within disciplines nationally and international especially rewarding.

While the methodology of cluster analysis is employed here, it should be noted that communicating ENCE data within disciplinary teaching communities embraces the pedagogical traditions of those disciplines. The article explores different student profiles that emerge through cluster analysis across the all-fields survey sample and for subsamples pertaining to particular professional courses, while also being informed by the periodic presentation of such data to different academic disciplines and professional communities in Chile.

About the Survey and its Analysis

ENCE 2019 was applied online in September and October that year in nine universities to first-year undergraduates and those having matriculated in 2016 (“fourth-year-in”, although not necessarily having reached fourth-year courses). As yet, all participant universities have been members of the Council of Rector of Chilean Universities (which includes around half of Chile’s total number of universities). This commonality has been instrumental in building confidence in the pooling of data, and the project has since welcomed universities recently having joined the Council. There were 9894 valid responses: 6250 first years, and 3644 fourth-year-ins. 63.6% of respondents were female and 36.4% male, a typical breakdown for fully voluntary online surveys (Smith, 2008). This represents a strong and fortuitous return (around a quarter of first years and 15% of fourth-year-ins within participating universities), especially given that the process was curtailed in mid-October 2019, as Chile was swept into debilitating protests and violence.

Informed by studies of past annual iterations of the instrument (Del Valle & Cumsille, 2019; Leihy, 2022; Leihy et al., 2019; Zapata et al., 2018), ENCE contains seven dimensions that both work statistically and allow readily graspable contrasts between types of student. These factors are:

- *Higher-Order Learning* (HOL), which is the intellectual challenge and creative work central to student learning and institutional quality. Students will ideally engage in complex cognitive tasks that require more than simple memorization of facts, applying knowledge and learning from practice. Higher-Order Learning encompasses such cognitive demands as the acquisition of new knowledge, the practical

- application of theories and methods, analysis and judgment, the synthesis of ideas and the navigation of quantitative and qualitative information;
- *Learning Strategies* (LS), referring to active learning and deep analysis of subject matter, rather than passive assimilation underlies greater capacity for learning. Effective learning strategies are patterned by identifying key information in readings, reviewing notes after class, summarizing course material, class participation and group work;
 - *Student-Teacher Interaction* (STI), recognizing that students' academic relationships with teachers positively influence cognitive development, personal growth, retention, and vocational directions;
 - *Quality of Interactions* (QI), tracing the interpersonal relationships with different members of the academic community that might promote a rich learning environment. Students who enjoy caring relationships with fellow students, administrators, counselors, faculty, and staff are able to find help when needed and to learn from and with those around them;
 - *Institutional Support* (IS), wherein fostering students' cognitive, social, and physical development fosters is linked to retention and higher levels of performance. Libraries, laboratories, counseling, student aid and health services are well documented examples;
 - *Interactions in Diverse Contexts* (IDC) universities provide a new context for students to interact with and learn from several others who have different backgrounds and life experiences. The opportunities to learn from students from other countries, ideological leanings, or religions, both inside and outside the classroom, prepare students for personal and civic engagement in a diverse and changing world; and
 - *Effective Teaching Practices* (ETP): Student learning depends, in large part, on effective teaching. The recognition of good organization of instruction, clear explanations, illustrative examples, and effective feedback on student work are critical components.

Furthermore, an additional dimension appearing in other student engagement analyses and concerned especially with self-initiated learning—*Academic Effort*—has been piloted in the online-only context of the early 2020s coronavirus pandemic, and remains under development for wider application.

Each dimension is measured through between four and seven survey items concerning the frequency with which students undertake practices that are known to impact upon learning. The indices for each dimension consist of an average of item scores between 1 (indicating something a student does not do) and 4 (something done with great frequency).

While the items that make up the dimensions are rarely identical between countries, they do correspond to dimensions used in the analysis of the North American National Survey of Student Engagement and others worldwide (McCormick et al., 2013). The validity and reliability of dimensions and items within a national context require careful adaptation and often reconstruction (Coates & McCormick, 2014), with ENCE having undertaken annual cycles of revision over half a decade (Zapata et al., 2018). A forthcoming book comparing student engagement surveys worldwide includes a chapter on ENCE's development (Leihy, 2022). We would certainly argue that ENCE can help inform various efforts in Latin America to ground student engagement and student experience surveying more generally within the varied but patterned structures of Latin American undergraduate education. This is especially true not only given the professional structures of undergraduate

education, but the much-changed nature of now universal schooling and the proliferation of credentialed professions.

Literature Review

This article pursues two connected lines of enquiry. Firstly, in the total survey sample including a variety of students from all undergraduate programs and within particular fields of study there emerge meaningfully different student clusters—of individuals similar to one another in ways different to other such groupings. A second consideration is how such patterns might be communicated within disciplines (classically grouped in quite separate faculties in Latin American universities) so as to connect with often different traditions and currents of teaching and learning. In analyzing data, dispassionate psychometric evaluation must contend with and anticipate evolving diversity within class cohorts, and also with efforts within universities to modernize and improve learning experiences. These lines of enquiry inform the study and are revisited in the Results, Further Discussion and Conclusion sections, with some synthesis of how student experiences between disciplines share tendencies and diverge.

It was not so long ago—two or three decades—that such a small proportion of Chileans reached university that university going could be discussed largely in terms of the reproduction of elites (Brunner, 2009). It was important that the fortunate few be well educated because, as some economists would put it, the deficit of human capital was imposing. Furthermore, it remains a quaint commonplace to describe Chilean and other Latin American education systems as “Napoleonic”. While they never convincingly gelled during Napoleon Bonaparte’s war-riddled reigns, Napoleonic education plans scheduled universal primary schooling, selective secondary schooling in the liberal arts and trades, and specialized professional higher studies in a nationally centralized, comprehensive conglomerate of institutions (Musselin, 2004). In calm retrospect, there were only ever shallow resemblances to this even during the Republic of Chile’s first century. The latter part of the twentieth century saw Chile rush to enforce compulsory primary schooling and increase retention at secondary level, with 2002 legislation making it obligatory that all students complete secondary schooling or reach the age of 20 trying to elude or eluding the authorities. From the late 1980s, higher education enrollments began to climb up off a rather modest base. As in many countries, university courses continue to be typically named to sound like good jobs, even though a university qualification is no longer a guarantee of work opportunities.

Across Latin America’s varied republics, the measurement of learning experiences is always complicated by adapting any measurement instrument or underlying validated item to local conditions. It has long been noted that universities collect great quantities of data characterizing their students, but systematic study of student experiences and professional development including lifelong learning has only taken root over the past decade (Brunner, 2009; Durón et al., 2020; González, 2010, 2015; Rivera et al., 2009). Furthermore, research has often focused on relatively specific contexts (González, 2010; González et al., 2011; Hinrichs et al., 2016; Parra, 2010; Polanco et al., 2014; Spormann et al., 2015).

Existing adaptations or indeed wholly autochthonous perspectives within the region are assets, but even then, there are important differences between countries used to comparing and contrasting one another’s approaches and progress. For the Latin American region, with its history of borrowing measures from other places and struggling to adapt them to local features, it is worthwhile to consider theoretical aspects underpinning the advancement of locally-anchored insight.

ENCE is by far the largest and most thoroughgoing student engagement survey in Latin America; apart from a Spanish version of the National Survey for Student Engagement for use in

Puerto Rico and also on occasion at Instituto Tecnológico de Monterrey in Mexico, recent efforts to develop comprehensive student engagement surveys in Mexico, Colombia and El Salvador (Durón et al., 2020), at Pontificia Universidad Católica de Perú and as of 2022 (with assistance from Chile's ENCE) in the Dominican Republic as yet remain at the pilot stage. That said, in Chile as in other parts of the region have cropped up other, more piecemeal studies exploring elements of student engagement. Many of these have focused on small samples and drawn on student engagement to report on the varied characteristics and preparation of students (Hinrichs et al., 2016; Parra, 2010; Parra & Pérez, 2010; Singer et al., 2019). A *University Student Engagement Inventory* devised by a Portugal-based statistician that diverges somewhat from other student engagement notions has also been piloted for health sciences at a single Chilean university with an eye to ready international comparability (Albornoz et al., 2020). There are further bodies of work (Aspeé et al., 2018; Chacón et al., 2018) deploying improvised instruments piloted with small samples adopting the term “student engagement” (*compromiso estudiantil*) but conflating student engagement surveying with the idea of social and civic engagement, a separate line of study promoted in many countries as part of school citizenship courses. This may reflect the fact that the word awkwardly used in Spanish for engagement—*compromiso*—more resoundingly corresponds to “commitment” and has iconically been used for conformity to a gamut of contending ideological angles especially during the 1960s. Throughout Latin America, there is considerable scholarly interest in student engagement (Pineda-Báez et al., 2014) and in developing instruments exploring different interpretations of student commitment and involvement (Ardila-Rodríguez, 2011; Daura & Durand, 2018). Special commendation is owed to the Brazilian scholars (Silva & Ribeiro, 2020) who have rendered student engagement into Portuguese as *engajamento estudiantil* (which sounds like student engagement, but more literally means ‘student hooking’). Likewise, in casual remarks at a conference, a Mexican academic once confided that his way of understanding engagement—so difficult to translate (Leihy, 2022)—is as *enganchamiento*: again, the process of catching something with a hook. In any case, there is merit in noting the disparate preparation of students who arrive at university in Chilean and Latin American higher education systems that have experienced rapid expansion. The central concern of student engagement is with how academic communities can help young adults, as well as mature-age learners, be more autonomous learners, and not necessarily to load them up with civic virtues or simply palliate the inequalities with which they reach higher education.²

Evidence mounts not only that students enter higher education under-prepared for the traditional exigencies often still reflected in curricula, but also that undergraduate education may be the best chance of leveling up academic achievement towards standards in developed countries. Among the tertiary educated in Chile, functional literacy is alarmingly low (73% in 2015, compared to a 93% average in the Organisation for Economic Cooperation and Development countries). Since functional literacy has been measured at 44% and 13% respectively for those with secondary and primary education it is nevertheless possible to argue that tertiary studies provide and/or reflect and vouch for better basic skill levels in areas such as functional literacy and numeracy (González, 2019).

There are many ways to imagine different kinds of students; from the expansion and tumult in the 1960s United States, Clark and Trow (1966) ventured one notional axis considering how intellectually-minded students were and another axis for how much they identified with their particular institution. Clark and Trow's axes may even be the ur-source of the pair of student engagement items that most pique the interest of enrollment planners worldwide: whether students would study the major or discipline that they have studied again if they had the chance (intellectual

² Although the transition from the former notion of Latin American universities as proving grounds for elite political circles (Lomnitz, 1977) to something more suitable to democratic aspirations appears to have been fumbled (Bernasconi & Leihy, 2020).

engagement), and whether they would attend the same institution (institutional identification). Clark and Trow labeled intellectuals committed to university life as *Academics*, *Collegiates* were partying or sporting types, *Non-Conformists* were outsider intellectuals, with otherwise unengaged *Vocationals* only being in higher education to get a qualification. Among others, Terenzini and Pascarella (1977)—influential scholars of the student experience—would test the Clark-Trow construct and find the set of quadrants empirically flawed. Another approach would be the idea of different learning styles either suiting different disciplines or indeed attracting suitable students to them, with Kolb (1981) suggesting certain proclivities in terms of how students in different fields approach learning. More recently, Ventura and Moscoloni (2015) applied Kolb’s model in the Argentinian context. While it is useful enough to separate disciplinary tribes (Becher & Trowler, 1989), the British parliamentary jargon of hard and soft, wet and dry is especially evocative of different scholarly types, and is perhaps more memorable than similar classifications of scholarly disciplines such as by Biglan (1973). Whatever the case, student engagement is less concerned with the task of showing how disciplines differ from one another; of course they differ, and they all have their own pedagogical customs and related scholarships of teaching and innovations to show for it (Brew, 2001; Neumann et al., 2002). What we can seek to illuminate, however, is difference in broad types of students within a given discipline.

Methodology

The underlying methodology of this study is cluster analysis, designed to identify and tease apart correlated subgroups within populations. Clusters represent greater internal consistency across a given number of factors in comparison to the tendencies of other groupings (Howard et al., 2012; Wishart, 2006). Within institutional analysis (which has become important within Chilean universities as they have grown), clustering allows an intuitive interface for demonstrating aspects of student diversity within and beyond immediate academic communities, and so assists in the better deployment of resources (Howard et al., 2012).

There exists a variety of algorithmic methods to determine the optimal number of clusters and their make-up (Brock et al., 2008). Previous cluster analyses applied to student engagement have employed typically elegant K-means clustering (Chang et al., 2020; Coates, 2007; Hu & McCormick, 2012; Moubayed, 2020, among others). In the current study, we augmented such an approach with a fuller battery of clustering methods. We first used the *clValid* statistical package available in R, which permits simultaneous evaluation of multiple clustering algorithms to establish the most appropriate number of clusters (Brock et al., 2008). *clValid* facilitates both internal measures (connectivity, silhouette width, and Dunn index), and external stability measures (APN, AD, ADM, FOM). Having considered nine of the most common clustering algorithms (Hierarchical, K-means, DIANA, PAM, CLARA, FANNY, SOM, Model-based clustering, SOTA), PAM (“Partitioning Around Medoids”) emerged as the most appropriate here.

PAM clustering was performed on both the entire sample and on study field subsets. PAM is similar to K-means, although it is considered more robust on account of minimizing noise and outliers within large data samples (Kaufman & Rousseeuw, 2009). PAM renders clusters (that is, K groups), each grouped around the most centrally located point in the cluster (its medoid), and sufficiently distant to other medoids. Conceptually, PAM suits the nature of ENCE data and especially the non-normal distribution of measured factors. In data samples featuring many overlaid values, it is often difficult to establish clustering, but PAM functioned well, particularly in conjunction with the Hopkins test, which gives indications even in “suboptimal” conditions as to cluster tendencies and the uniformity of data distribution. The number of clusters also takes into account connectivity, *silhouette* analyses, and Dunn index, reported below.

In the Appendix, Table 1, mean values and standard deviation for all the analyzed dimensions are included for each discipline cluster and for those from all disciplines. Determining the optimal number of clusters is one of the most complicated steps in cluster analysis, and in selecting the best adjustment of data. In this case, the process was assisted by the conviction that simply slicing off a pair of “high” and “low” clusters with enough internal correlation can be dismissed as manifestly inadequate for at least two reasons. One reason is that registering more uniformly very high and very low scores may say more about the respondents’ personalities than it does in any nuanced way about their engagement, and another is that for the data to be useful within academic communities, several rather than a couple of categories allows interesting contrasts and reflections. There is codependency between the number and quality of clusters; certainly in deciding on which number above two, values gleaned from a range of tests were considered. Through applying the test procedures, the overall sample and those for the four professional disciplines convened in each case around reporting three to five clusters according to what turned out in each case to be five naturally grouped dimensions.

Two of the seven engagement dimensions would contribute little to the clustering exercise. Interactions in Diverse Contexts and Effective Teaching Practices are absent from all clustered statistics. Like the others, Interactions in Diverse Contexts was adapted from the National Survey of Student Engagement, which recognizes a North American concept of diversity drawing on civil rights and equity notions. Without doubt Chile is becoming more conspicuously diverse through immigration and the self-identification of different subcultures, and the dimension functions statistically in its own right. Indeed, it is possibly this molten awareness of pluralist diversity throughout campuses that sees it as yet less discriminating in cluster structures. For its part, the dimension of Effective Teaching Practices appears to betray considerable variability between universities, as would befit institutions that increasingly experiment with educational innovation. These two dimensions did not contribute to the coalescence of distinct clusters, and as such were excluded from that aspect of analysis.

Across the nine universities, 9894 students filled out ENCE 2019. The clustering process saw the exclusion of almost half the cases, with 4952 cases offering valid responses for all of the engagement factors. The four subsamples consist of 679 Civil Engineering students, 247 students of Law, 159 of Medicine and 637 Teaching students. While only six of the universities as yet have Medicine programs and eight offer Law, all nine universities offer the other three disciplines. Quite apart from reporting on and analyzing clusters of engagement tendencies, it is also worth noting that the challenge of communicating such information within learning communities has advanced in tandem with the development of the Chilean instrument since the middle of last decade. In this article (as in many reports and presentations within institutions and for professional groups) cluster diagrams are presented below using “spiderweb” diagrams. The concentric pentagons of each spiderweb are numbered in standardized mean differences, using a scale from -2 to 2. The average of the factor indices and their standard deviation, in the original scales, are reported in the Appendix, Table 1, where differences between the different samples are displayed. While stereotyped high and low response groups on their own without complementary intermediate categories can be dull and over-obvious in presenting contrasts, in each of the cases included here a pattern of students giving consistently higher scores (forming a near perimeter of each spiderweb as it presented) is included. In view of their general satisfaction, in each applicable case (no such cluster is detectable in Medicine) we pointedly term this cluster *Rave Reviewers* (rather than simply labeling them “highly engaged”—some may just be more habitually generous raters). Likewise, in all cases but Medicine—where low contact is improbable—clustering revealed a subgroup reporting low scores, generally jaggedly around the spiderweb’s bullseye. This cluster is not deemed alienated as such, but rather

termed *Malcontents*. No particular intimation (nor pejorative sense) is intended about whether the *Malcontents* are unhappy with what they are studying, with their institution, or with life in general. It is interesting in its own right that members classed here as *Malcontents* have logged on (often using institutions' cellphone applications) and filled out the survey, and in the continuous improvement of the survey and its impact, it is certainly worth canvassing students who voice such dissatisfaction for focus groups and interviews about their experiences. Note that throughout we deploy memorable descriptors as cluster names, as we have found that such terminology allows better intuitive uptake of the material and often interfaces well with pre-existing studies and field experience about student life and learning styles in professional disciplines whose practitioners know their changing student bodies well.

Results

Clusters in Total Sample

The ENCE project has concentrated on developing a valid instrument suitable for all undergraduates, beginning with universities subscribed to the longstanding Council of Rectors. This has offered a good vantage point over a range of mostly firmly established institutions with experience working together; the combined Council of Rectors-affiliated student bodies comprise a reasonable sample of those in Chile aspiring to a good-quality higher education. Before considering the selection of four professional disciplines, it makes sense first to analyze clusters within the whole ENCE sample, including undergraduate students in all fields in their first and fourth year since matriculating. Providing empirical evidence of the kinds of experiences students have can confirm or challenge normative assumptions about the sort of education on offer and also indicate different experiences among students, including those having less traditional backgrounds and living arrangements compared to generations ago. While it is important that students reach suitable levels of competence in a given field, so too are generic skills that enrich their experience of life and learning. Further, how the program and institution can meet the students' needs is part of engagement.

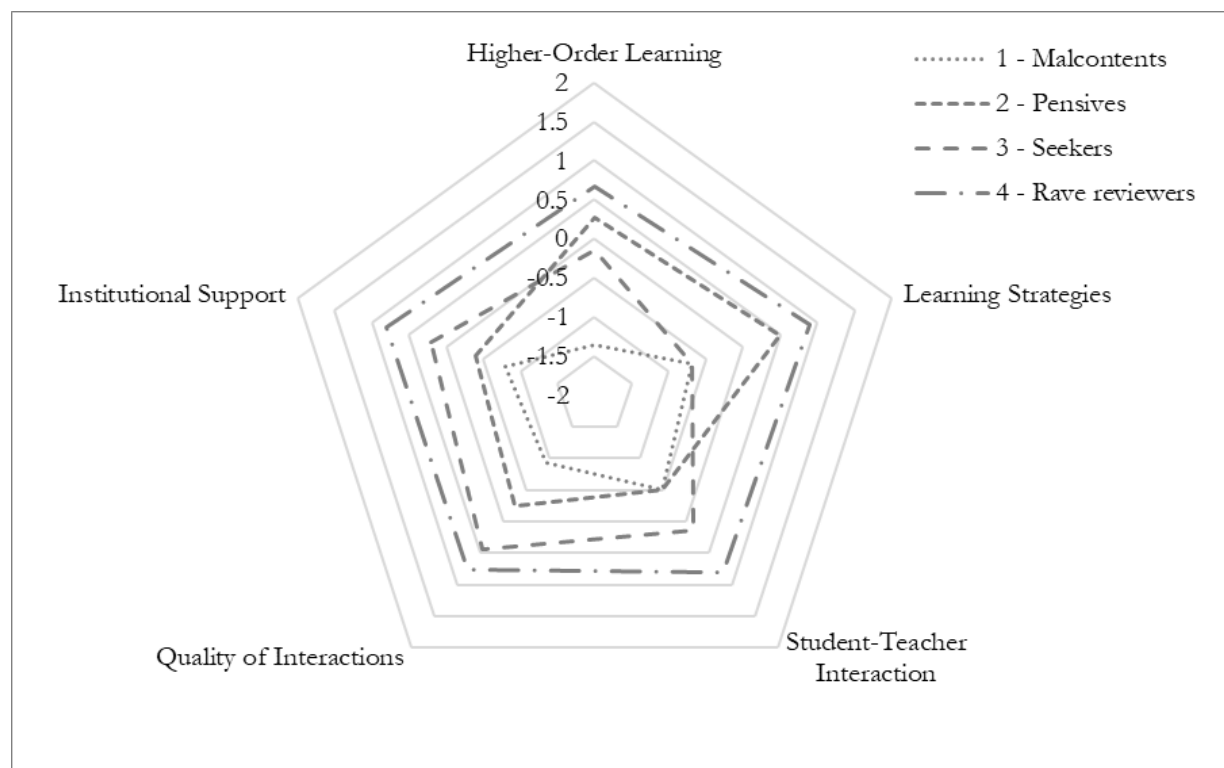
At the aggregate level of the whole sample, four clusters emerge strongly from five engagement dimensions: Higher-Order Learning, Student-Teacher Interaction, Learning Strategies, Quality of Interactions, and Institutional Support. These roughly proportionate clusters include 4952 students, drawing in well over half of the combined first-year and fourth-year-in cohort samples; we assign the here-standard terms *Rave Reviewers* and *Malcontents* for those consistently high and low indications, with two intermediate groups that we term *Pensives*—fairly intellectual but not heavily engaged with many areas of institutional culture and support, reminiscent of Clark and Trow's *Non-Conformists*— and *Seekers*, who like Clark and Trow's *Collegiates* avail themselves of institutional supports and are generally sociable, but appear less intellectually engaged.

The *Rave Reviewers* cluster is formed from 1336 students who report high commitment across all factors in the model, while the *Malcontents* represent 1040 students consistently reporting low levels of engagement in all dimensions.

Pensives ($n=1284$) report fairly high commitment, especially in Learning Strategies and items related to the application of learning, but markedly lower social interaction, including with academics and support services. As this cluster included more fourth-year-in students, it may reflect greater academic autonomy. The *Seekers* grouping (1276) includes more first years, reporting accessing support services (Institutional Support) and solid interaction with the academic community, but display low engagement in Learning Strategies and Higher-Order Learning as such.

Figure 1

Engagement Means (Z Score) Clusters Grouping 4952 Students from ENCE 2019 Full Sample



Notes: Hopkins index= 0.3183506; connectivity= 1,738; cluster silhouette width= 0.169; Dunn index= 0.0155.

In presenting the data to academic communities and general publics throughout Chile, these four groups stimulate fruitful discussions, not least about nature and nurture in terms of student personalities and socialization. From here, student engagement patterns within four professional disciplines can be contemplated.

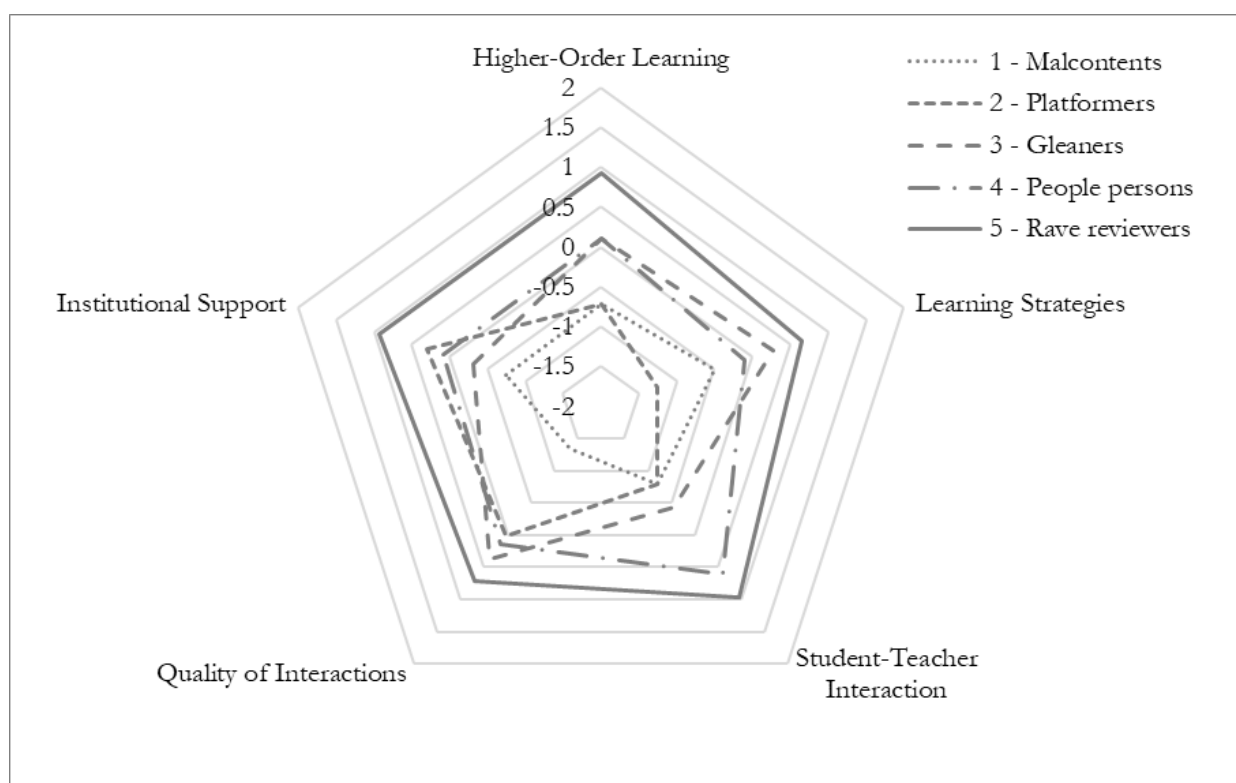
Civil Engineering

As in many developing (to say nothing of seismically active) countries, Civil Engineering has long been a prestigious discipline in a Chile in constant need of infrastructure. Engineering has also historically often proved a logical and attractive first-in-family university experience and then middle-class existence for students with family members working in the manual trades (Verdin & Godwin, 2015). Student bodies in Civil Engineering remain very masculine, but interestingly over two-fifths of first-year survey respondents are female, while by fourth-year in this number drops by under a third, which is proportionate with higher female attrition in the discipline, as well-documented throughout Latin America (Aranzazu & Rojas, 2018; Sánchez et al., 2018). In both cases, the sample is considerably more female than Civil Engineering enrolments; see the Appendix, Table 2, for a general breakdown of statistics by cohort and gender. Civil Engineering has a heritage of extensive contact hours, which institutions have been under pressure to fit into fewer semesters, and to reform educational practices in general (Celis & Hilliger, 2016). Among Civil Engineering students ($n=679$) across programs (including various specialisms, such as Industrial, Mechanical, Electrical, Information Systems, and Construction) across all nine universities, clustering identified a fairly similar number of Rave Reviewers (142) and Malcontents (128), among whom, it is worth noting,

Quality of Interaction and *Student-Teacher Interaction* may be low by Civil Engineering standards but are relatively high by all-fields standards. Three further groups emerge, here named *Platformers* ($n=109$), *Gleaners* (130) and *People Persons* (170). Platformers engage considerably in terms of Institutional Support and Quality of Interactions and little in anything else. Gleaners focus on learning materials and high-quality interactions, while People Persons are strong on social interaction including with teachers. Without doubt, the Civil Engineering sample suggests robust academic cultures. Spiderweb graphs have proved particularly popular when presenting data in engineering faculties and with professional associations whose members, as in other countries, are often concerned about the quality and quantity of engineers in the pipeline.

Figure 2

Clusters (Z Score Means), Civil Engineering



Notes: Cluster means drawn from a sample of 679 Civil Engineering students. Hopkins index= 0.3356389; connectivity= 400; cluster silhouette width= 0.1605; Dunn index= 0.0594.

Law

Throughout Latin America, thick and often idiosyncratic legal codes traditionally dominate the study of Law, and require lawyers in their arguments and signed documents to apply statutes and principles to whatever contingency. Chile, like most places (Menkel-Meadow, 2013), has in recent decades acquired a glut of qualified lawyers, notwithstanding the use of a national bar examination to test graduates' abilities to submit themselves to a particular intellectual tradition. Changes in teaching styles and content are evolving, including with influence from the case study approach and mooted practice that are influential in legal education in "Anglo-Saxon" common law systems. Equally, mannered homegrown discourses around concepts such as human and social rights, and difficulties

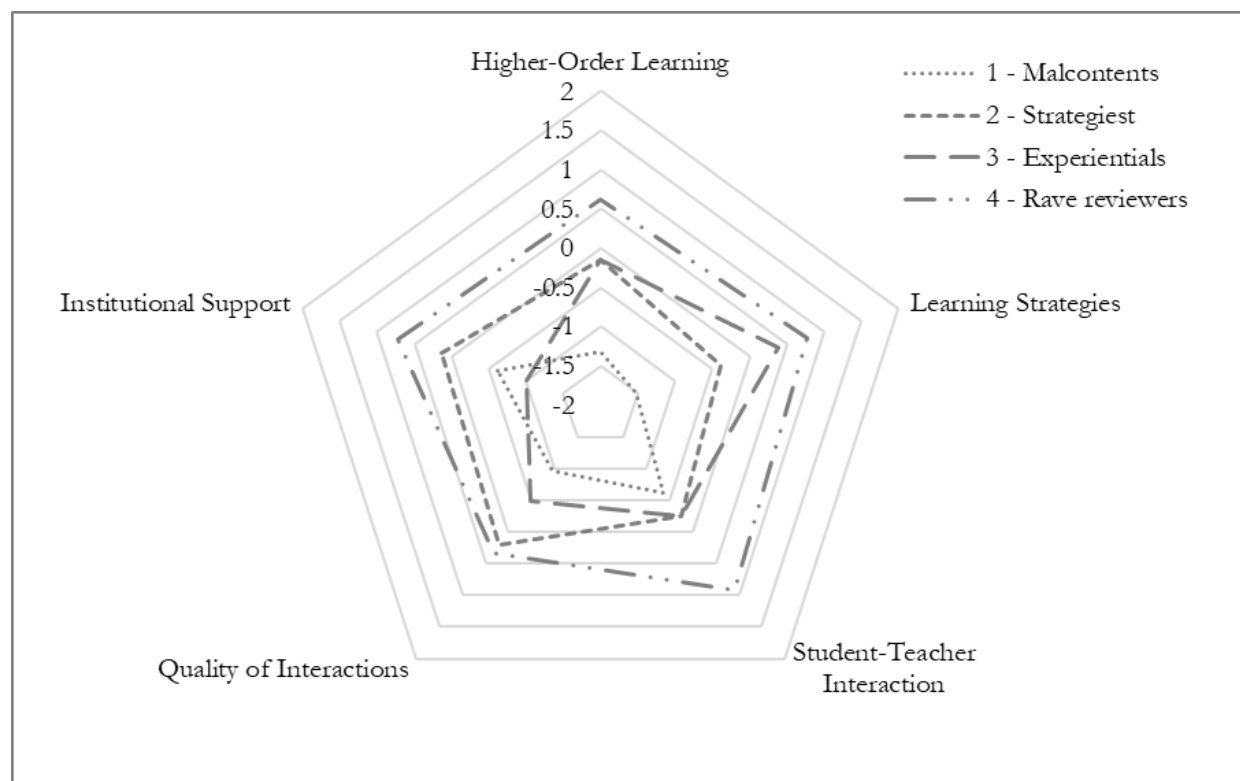
around the legitimacy of constitutional and institutional law, as well as compatibility with international arbitration, are electrifying dimensions of the professional discipline.

From analysis of ENCE 2019’s Law students (found at all but one of the participating universities), four clusters emerge. There are both Rave Reviewers (and the well-rounded, politically minded Law student is a classic Latin American trope) and Malcontents (the reluctant Law student is common enough worldwide). From a sample of 247 Law students, there are 75 Rave Reviewers and 39 Malcontents. In between, we term one group ($n=59$) Strategists and other Experimentals (74). The Strategists are relatively focused on subject material and Learning Strategies, which indicates mindfulness of acquiring the knowledge and study skills to piece together the puzzle of articles and statutes through which Chilean law is navigated, which is necessary for the high stakes summative bar exam upon which entry into professional status depends. Experimentals match the Strategists even in areas of the latter’s engagement strengths, and generally report a rounded engagement experience across the dimensions, albeit not the same heightened level as Rave Reviewers.

Importantly, apart from the Rave Reviewers, levels of student-teacher interaction are lower than in wider survey sample; a recognized disciplinary foible in a highly magnetic but high-attribution field). As a conversation framer at least, in presenting the data to Law schools, there are implications for legal studies that have drifted from the wide-ranging and curiosity-piquing education they once capped.

Figure 3

Clusters (Z Score Means), Law



Note: Cluster means drawn from a sample of 247 Law students. Hopkins index= 0.3160251; connectivity= 140; cluster silhouette width= 0.1776; Dunn index= 0.0508.

Medicine

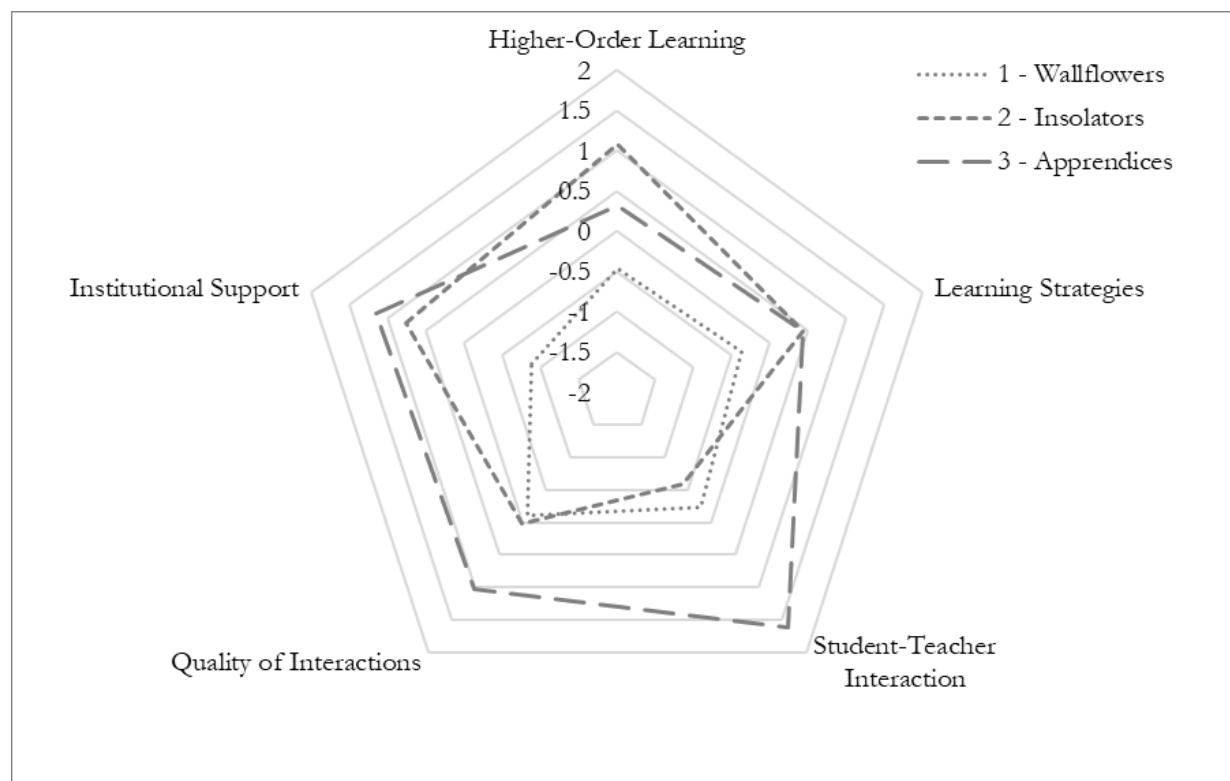
As everywhere, the training and general cognitive demands of medical studies are changing throughout Latin America. The old task of a medical student assembling an encyclopedic sense of human anatomy and pathologies is nowadays largely left to students to learn themselves, with more interactive virtual learning and clinical simulation materials, and fewer cadavers. The focus of much initial medical education around the world has shifted towards patient care (once acknowledged *en passant* as “bedside manner”, but now carefully fostered in the context of team-based treatment protocols and interpersonal awareness). The strength of Chilean Medicine over the second half of the twentieth century mostly lay in population health and public health policy rather than clinical settings, and the great opportunity now is for the more efficient incorporation of diagnostic and therapeutic technologies and better medical education around market-driven prescription. Rich seams for progress lie in the genetic differences between Chile’s and other Latin American populations and those in countries where pharmaceuticals and other therapies have originated. Other priorities include pharmacognosy (the discovery of new medicines, where Latin America’s alkaloid-rich flora remain under-researched) and accessible gerontology in societies that have added decades to life expectancy in a couple of generations.

From a sample of 159 Medicine students, at six universities, no cluster fitting the *Malcontents* moniker was found (such individuals would probably not last long in decent medical schools, which rely on resources invested generously by the state and professional community). Neither is any *Rave Reviewers* contingent present. The smallest cluster ($n=25$) is distinguished from the others mostly by registering higher Quality of Interactions and Student-Teacher Interaction; we term the group Apprentices to evoke the sense of collegial and yet hierarchical teaching traditional in the field. Another group appears intellectually engaged, reporting much Higher-Order Learning, but appears less sociable, with the cluster here termed *Isolators* (46). A third group is dubbed *Wallflowers* (88), and the “shape” of its array of dimensions is similar to that of the Apprentices, only with much lower levels of across the board. In the case of both Isolators and Wallflowers, it would be possible to consider more effective ways of bringing student and institutional resources together. One underlying effect that bears mention is that first-year students report lower levels of Student-Teacher Interaction, which may be a compounded combination of relatively distant introductory teaching methods and incoming students’ expectations for more hands-on involvement; this engagement dimension notably rises for those respondents four years in. As with small subsamples in general, the psychometric properties for Medicine are not as strong as with wider and richer samples, but in combination with insights into the wider university population, the picture of diversity of engagement within medical training complements the considerable work that Chilean medical schools devote to curricular and pedagogical innovation. The cluster differences make for a striking graphic (Figure 4).

The juxtaposition of one cluster of medical students reporting much Higher-Order Learning with otherwise lower engagement, and another reporting a high quality and extensiveness of pedagogical interactions is especially interesting when considering the evolving skill reservoirs necessary to crew the variegated and ever-changing enterprise of health work.

Figure 4

Clusters (Z Score Means), Medicine.



Note: Clusters means drawn from a sample of 159 Medicine students. Hopkins index= 0.3668005; connectivity= 63; cluster silhouette width= 0.1966; Dunn index= 0.0934.

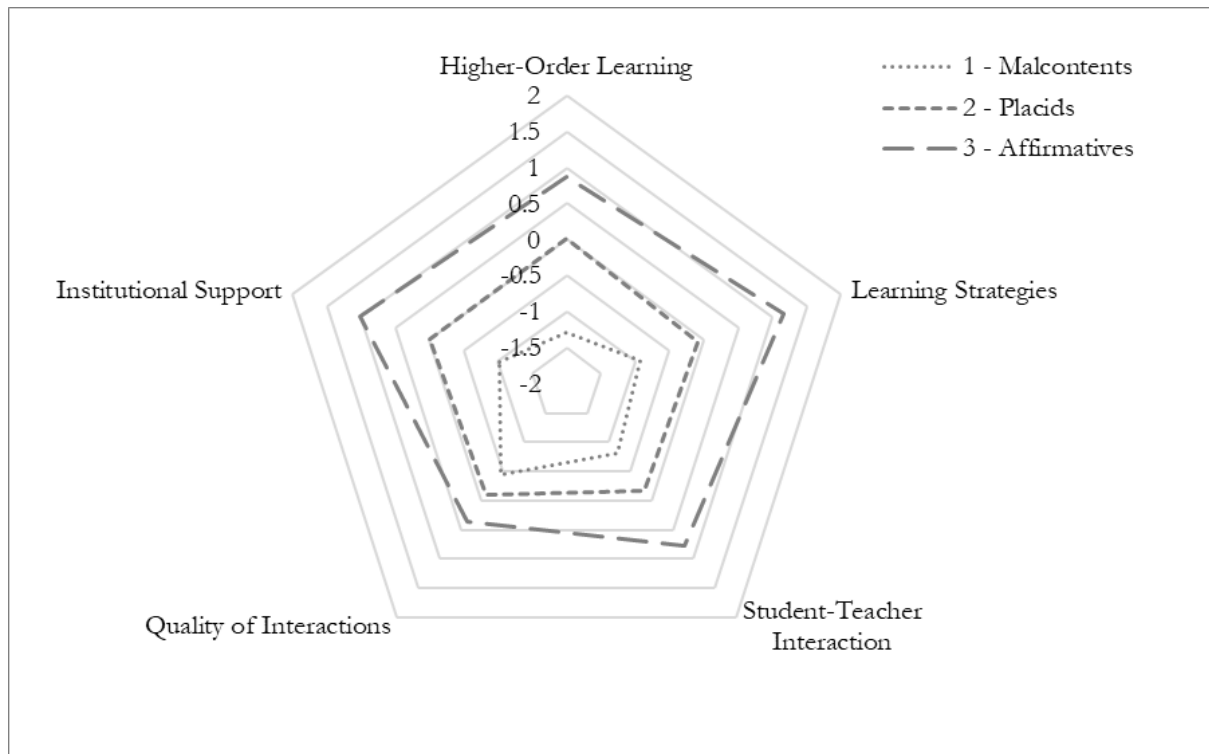
Teaching

Teacher education is a field that is reflexively rich in pedagogical innovation, and yet is of pressing concern given Chile's difficulties in resourcing and maintaining morale in the schooling sector. According to the tradition of understanding every undergraduate degree as training for some profession, what in other systems might be studied first as a humanities or social science degree is often formulated in Chile and other Latin American countries as a teaching degree. By contrast, in many institutions, the pure sciences will have dedicated disciplinary degrees that may subsequently be linked to pedagogical training through bridging courses. As in other countries, early childhood and primary teacher education tends to be more multi-disciplinary. For Teaching, three clusters reveal a range of student experiences woven across the various strands of teacher education. From a sample of 637 Teaching students from all nine universities, three clusters can be identified. *Malcontents* ($n=155$) are present, but also another group precisely twice as large that reports mildly and yet uniformly higher engagement (albeit only to neutral level) and is here named the *Placids* (310). A final cluster reports solidly positive engagement, but not to any great extent, earning the moniker *Affirmatives* (172). The three clusters are arranged essentially concentrically. They most nearly converge in the dimension of Quality of Interactions, perhaps reflecting the essentially sociable nature of teacher education (Pianta, 1999). In the context of Chile's ongoing efforts to reform the teaching profession, the cluster data across institutions (as here), or benchmarked for a particular institution or program against such the national picture, can offer valuable insight. This terraced

pattern of levels of engagement among student teachers issues a challenge to teacher educators for building motivation and sense of belonging among future teachers whose own work will typically involve similar encouragement.

Figure 5

Clusters (Z Score means), Teaching.



Note: Clusters means drawn from a sample of 637 Teaching education students. Hopkins index= 0.3268674; connectivity= 259; cluster silhouette width= 0.1713; Dunn index= 0.0328.

Working with these three evident levels of engagement is something for teacher educators, institutional support, administrators and policy makers to bear in mind. To reiterate, the Teaching sample includes students preparing to teach at different levels—early childhood, primary and secondary (often with interests towards a particular age band therein, and/or pedagogical modality)—but there surely is common cause for boosting the engagement of student teachers across the levels.

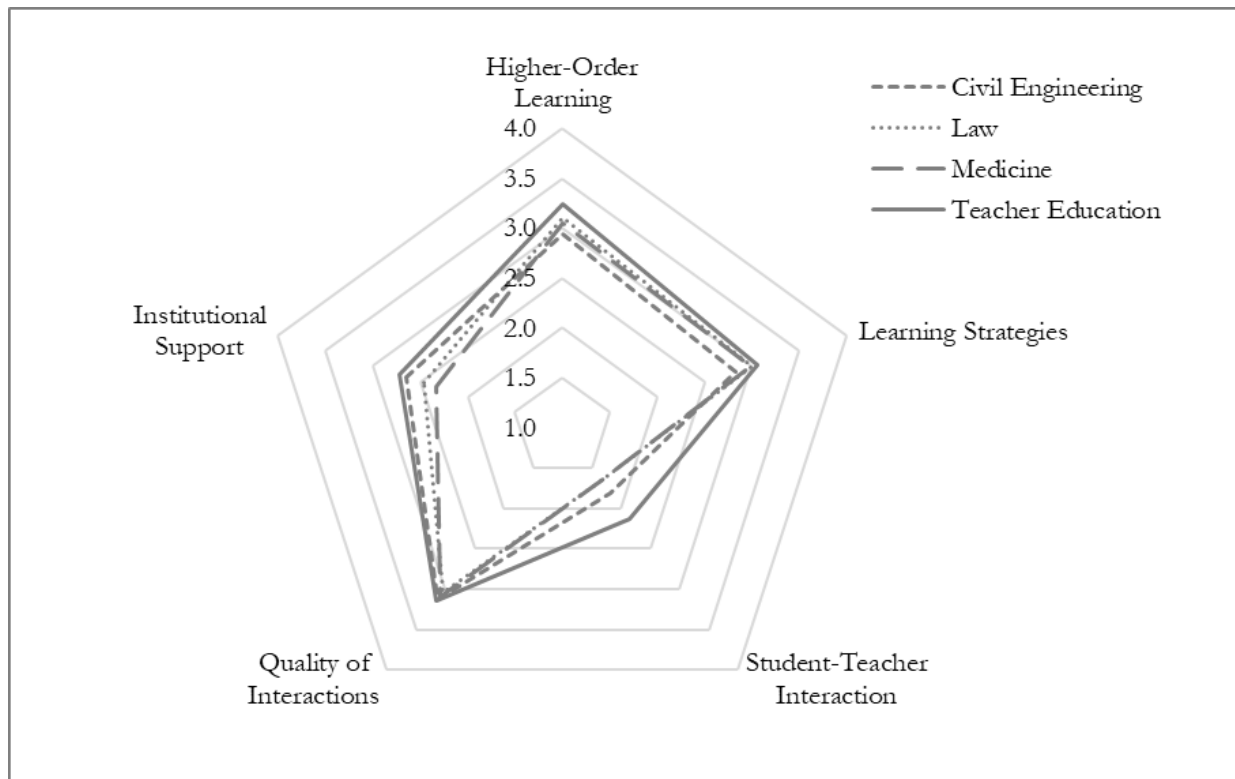
Further Discussion

This study has pursued tandem lines of inquiry. Firstly, demonstrating, across the undergraduate student sample and within disciplines drawn from four contrasting professional disciplinary styles, that there are noteworthy clusters of patterned student engagement orientation. Secondly, reference is made to how student engagement data can inform particular traditions of learning. Together, the cluster offers a novel framing that might assist in directing efforts and resources towards student needs. It remains, then, to consider how the clustering detected

throughout undergraduate studies reflects the coverage of, in this case, Chilean society's needs. It should be noted that neither the current exercise nor analysis of ENCE data in general pretends to 'rank' institutions or their programs against one another, but rather to provide general benchmarks of patterns in student engagement. The focus is on using rich aggregate data in order to experiment with and consolidate institutional supports for student learning.

Throughout the sample, there are clusters of highly and lightly engaged students; the Rave Reviewer and Malcontent labels acknowledge both this and the observable personality trait (or momentary sentiment) of some survey participants simply to rate things consistently highly or lowly. The absence of Malcontents from the Medicine subsample attests to the extensively scheduled nature of medical training, but even then, another group ("Wallflowers") suggests that for some students, institutions may be able to appreciate different attitudes and personalities and adjust learning opportunities to suit. Similarly, there are no Rave Reviewers in Medicine, but rather different configurations of relatively intense engagement. Without doubt, further qualitative work is worthwhile focusing on those who fit the Rave Reviewer profile (there is usually no shortage of such sanguine students volunteering for focus groups and other representative functions) in a given discipline, and exploring similarities and differences between such disciplines. Equally, Malcontents who bother to fill out the survey are clearly worth consulting in depth, and this is a sideline of survey development. While the aforementioned Rave Reviewer and Malcontent clusters clearly diverge, the sharply or subtly contrasting groupings that fall between can expose other important patterns with implications for learning design. In the whole sample, the "intermediate" clusters termed Seekers and Pensives perhaps reflect sociable and reflective tendencies that can be worked with in order to harness natural tendencies. Such groupings can also, however, prompt institutions in the pursuit of balanced engagement (just as the *Non-Conformist* and *Collegiate* labels [Clark & Trow, 1966] spurred interest in student diversity a half-century ago in the US). Should that seem overly trite, clusters in the different disciplines reveal patterns that appear to resonate at least with teaching and support communities. Civil Engineering's different clusters' contrasting engagement levels may equally call for dual supports and endorse such enterprises as problem-based learning (already advanced in many Latin American engineering schools). For Medicine (whose clinical side is fundamentally problem-based learning), differences of the intensity of engagement between clusters may have repercussions for future team-based work with other health professionals in clinical and research settings. In Law, the range of engagement clusters perhaps reflects a "sink or swim" disciplinary heritage, while in the three "ringed" clusters in Teaching reflect the deep difficulty in Chile as so many other countries in strengthening teacher education uniformly. Such insights into discipline-couched diversity (including colorful labels) tend to resonate among the academics and institutional support teams who guide students.

Figure 6 displays the point averages obtained by the four disciplinary subsamples, with details provided in the Appendix, Table 1. Although cluster analysis traces internal difference within such samples, in terms of absolute point averages (using ENCE's scale from 1-4), the disciplines are fairly similar. Certainly there are differences in the Student-Teacher Interaction dimension, where Teaching students report higher levels. Medicine students attest to lower levels of Institutional Support than others. Overall, however, the consistency of average responses between the differently sized subsamples is remarkable.

Figure 6*Engagement Mean Values in Disciplinary Subsamples*

Note: Mean values [1-4] in five engagement dimensions. Subsets: Civil Engineering ($N=679$), Law ($N=247$), Medicine ($N=159$) and Teacher Education ($N=637$).

Just as there are evident differences between disciplines, this general agreement indicates that ENCE's psychometric properties reflect the broadly common way in which Chilean students perceive the different engagement dimensions as constructed in the survey.

Conclusion

Differences between and within professional disciplines is but one aspect of the wide diversity with which much expanded higher education in Latin America must contend. It is through disciplinary educational structures, however, that organic changes might be made. By understanding varied but patterned learning styles, institutional resources may be better directed. Any research agenda for student engagement in Chile draws on cooperation with a growing range of institutions. Ultimately, ENCE works on the trust between institutions, and trust in the survey project itself. Together, participating institutions compile and develop a shared body of data not so that the institutions might strategize against one another for zero-sum positioning, but rather to identify and improve on strengths and weaknesses within their academic communities. In Chile, sharing good uses of engagement data is becoming part of the culture among and beyond ENCE's participant institutions (Del Valle & Cumsille, 2019). Chilean universities, which for two decades enjoyed access to World Bank-matched funding to support institutional improvement (Salazar & Rifo, 2020), now almost all boast units of institutional analysis that are conversant in refracting data

compatible with that of student engagement in order to assess, query and strengthen the claims of academic programs for resources dispensed by rectories and the often even more powerful comptrollers, accreditation agencies, government and other funding sources. By their nature, disciplines differ conceptually, and the programs that support them in different institutions have much to share with one another. This is borne out in the cluster analysis, which advances empirically robust student engagement talking points that are relevant to teaching and learning realities.

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Appendix

Table 1

Clusters Mean Values and Standard Deviation in Selected Engagement Factors

Clusters	N	Higher-Order Learning		Learning Strategies		Student-Teacher Interaction		Quality of Interactions		Institutional Support		
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Civil Engineering	1. Malcontents	128	2.53	0.50	2.61	0.53	1.34	0.38	2.42	0.40	2.01	0.53
	2. Platformers	109	2.47	0.48	2.00	0.39	1.38	0.34	3.20	0.35	2.77	0.61
	3. Gleaners	130	2.97	0.45	2.75	0.53	2.41	0.47	3.10	0.42	2.67	0.49
	4. People persons	170	2.99	0.49	3.10	0.44	1.39	0.30	3.28	0.36	2.43	0.48
	5. Rave reviewers	142	3.57	0.39	3.38	0.45	2.54	0.71	3.55	0.40	3.37	0.53
	Total	679	2.94	0.60	2.82	0.65	1.81	0.72	3.13	0.53	2.65	0.69
Law	1. Malcontents	39	2.32	0.55	2.07	0.41	1.22	0.24	2.52	0.43	1.90	0.53
	2. Strategists	59	3.06	0.58	3.33	0.41	1.39	0.50	2.73	0.42	1.79	0.45
	3. Experientials	74	3.54	0.45	3.50	0.38	2.24	0.67	3.35	0.44	3.17	0.62
	4. Rave reviewers	75	3.10	0.48	2.72	0.45	1.51	0.46	3.21	0.36	2.58	0.40
	Total	247	3.10	0.64	3.00	0.66	1.65	0.65	3.03	0.52	2.46	0.75
Medici	1. Wallflowers	88	2.64	0.46	2.74	0.62	1.50	0.50	2.96	0.52	1.92	0.47
	2. Insolators	46	3.59	0.45	3.30	0.51	1.35	0.28	3.04	0.54	2.72	0.57
	3. Apprendices	25	3.47	0.51	3.21	0.53	2.77	0.64	3.53	0.34	3.05	0.61

		Higher-Order Learning		Learning Strategies		Student-Teacher Interaction		Quality of Interactions		Institutional Support		
Teaching	Total	159	3.05	0.65	2.98	0.63	1.66	0.68	3.07	0.54	2.33	0.70
	1. Malcontents	155	2.61	0.47	2.57	0.57	1.56	0.50	2.76	0.52	2.02	0.52
	2. Placids	310	3.29	0.43	3.00	0.46	2.02	0.65	3.13	0.47	2.73	0.53
	3. Affirmatives	172	3.74	0.33	3.59	0.37	2.86	0.70	3.49	0.44	3.32	0.51
	Total	637	3.25	0.58	3.06	0.60	2.13	0.79	3.14	0.54	2.72	0.70
Total	1. Malcontents	1043	2.38	0.46	2.48	0.56	1.43	0.47	2.58	0.48	1.97	0.54
	2. Pensives	1287	3.58	0.41	3.45	0.40	2.59	0.76	3.51	0.37	3.19	0.58
	3. Seekers	1282	3.00	0.45	2.47	0.43	1.96	0.63	3.31	0.36	2.70	0.53
	4. Rave reviewers	1340	3.25	0.46	3.25	0.41	1.50	0.46	2.90	0.46	2.31	0.54
	Total	4952	3.09	0.62	2.94	0.63	1.89	0.76	3.09	0.54	2.57	0.71

Note: ENCE 2019, disciplinary and total sample clusters.

Table 2

Clusters Cohort and Gender Percentage Distributions

		Cohort/Gender - Percentage Distribution								
		2016 Cohort			2019 Cohort			Total		
Clusters		Male	Female	Total	M	F	Total	Male	Female	Total
Civil Engineering	1. Malcontents	52.6%	47.4%	100%	60.6%	39.4%	100%	57.0%	43.0%	100%
	2. Platformers	62.1%	37.9%	100%	73.8%	26.3%	100%	70.6%	29.4%	100%
	3. Gleaners	73.8%	26.2%	100%	66.2%	33.8%	100%	70.0%	30.0%	100%
	4. People persons	59.1%	40.9%	100%	55.8%	44.2%	100%	57.1%	42.9%	100%
	5. Rave reviewers	62.5%	37.5%	100%	72.1%	27.9%	100%	68.3%	31.7%	100%
	Total	62.3%	37.7%	100%	65.3%	34.7%	100%	64.1%	35.9%	100%
Law	1. Malcontents	38.9%	61.1%	100%	57.1%	42.9%	100%	48.7%	51.3%	100%
	2. Strategists	17.4%	82.6%	100%	16.7%	83.3%	100%	16.9%	83.1%	100%
	3. Experientials	31.6%	68.4%	100%	40.0%	60.0%	100%	37.8%	62.2%	100%
	4. Rave reviewers	30.4%	69.6%	100%	48.1%	51.9%	100%	42.7%	57.3%	100%
	Total	28.9%	71.1%	100%	39.6%	60.4%	100%	36.0%	64.0%	100%
Medicine	1. Wallflowers	62.5%	37.5%	100%	44.6%	55.4%	100%	51.1%	48.9%	100%
	2. Insolators	25.0%	75.0%	100%	47.1%	52.9%	100%	41.3%	58.7%	100%
	3. Appendices	66.7%	33.3%	100%	62.5%	37.5%	100%	64.0%	36.0%	100%
	Total	54.7%	45.3%	100%	48.1%	51.9%	100%	50.3%	49.7%	100%
Teaching	1. Malcontents	35.3%	64.7%	100%	35.6%	64.4%	100%	35.5%	64.5%	100%
	2. Placids	22.9%	77.1%	100%	32.2%	67.8%	100%	29.0%	71.0%	100%
	3. Affirmatives	25.0%	75.0%	100%	25.8%	74.2%	100%	25.6%	74.4%	100%
	Total	27.1%	72.9%	100%	31.0%	69.0%	100%	29.7%	70.3%	100%
Total	1. Malcontents	38.8%	61.2%	100%	39.8%	60.2%	100%	39.3%	60.7%	100%
	2. Pensives	32.7%	67.3%	100%	35.1%	64.9%	100%	34.3%	65.7%	100%
	3. Seekers	47.0%	53.0%	100%	53.6%	46.4%	100%	51.0%	49.0%	100%
	4. Rave reviewers	27.4%	72.6%	100%	28.5%	71.5%	100%	28.1%	71.9%	100%
	Total	36.6%	63.4%	100%	38.9%	61.1%	100%	38.0%	62.0%	100%

Note: ENCE 2019, disciplinary and total sample clusters.

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