Evaluating and Profiling Student Engagement and Motivation at a Higher Education Institution

Jarno Einolander[1], Hannu Vanharanta[2], Magdalena Mądra-Sawicka[3],
Joanna Paliszkiewicz[4], Jussi Kantola[5], Piotr Pietrzak[6]

Abstract:

Purpose: This study aimed to identify the main areas and features of student engagement at a university. The research also focuses on evaluating the main features of student engagement that can be used for profiling student motivation.

Methodology: The data for this study was gathered at the end of the spring semester of 2018 at the Warsaw University of Life Sciences (WULS), one of the largest life sciences universities in Poland, using an Internet-based instrument called Evolute. The data in this research consisted of self-evaluation responses from 242 undergraduate students on Master's and Bachelor's programs. The respondents filled out an online questionnaire.

Findings: The results were presented in a three-stage analysis (descriptive statistics, a fuzzy logic-based method, and a clustering method for profiling student engagement). The results identified some key attributes of student engagement. The highest creative tension was noticed in student satisfaction, which reflects a gap in that area that could be improved by the university. The findings showed that highly motivated students presented high values in routinization and goal progress.

Practical implication: The proposed solution could be used for further profiling according to applied additional criteria, such as type, of course, year of education, lecturers, work experience, etc.

Originality/value: The study findings hold essential theoretical and practical implications for educators and researchers seeking to understand how students evaluate their engagement and reveal the gaps in university committees.

Keywords: Student engagement, evaluation, higher education, profiling, cluster analysis.

JEL Classification: M2, I23.

Paper Type: Research article.
Acknowledgments: We would like to thank all the students who participated in this study.

[1]*University of Vaasa (UVA), Vaasa, Finland; School of Technology and Innovations, Department of Production, ORCID: 0000-0002-3544-7000; jarno.einolander@gmail.com;*

[2]*The same as in 1, Poland, ORCID: 0000-0002-2911-084X, hannu@vanharanta.fi;*

[3]*Warsaw University of Life Sciences – SGGW, Warsaw, Poland, Department of Finance, Institute of Economics and Finance, Warsaw Poland, ORCID: 0000-0001-7842-889X; magdalena_madra@sggw.pl;*

[4]*Warsaw University of Life Sciences – SGGW, Warsaw, Poland; Institute of Management, Warsaw Poland; ORCID: 0000-0002-6250-0583; joanna_paliszkiewicz@sggw.pl;*

[5]*Poznan University of Technology (PUT), Faculty of Engineering Management, ORCID: 0000-0001-8660-9068; jusilakan@gmail.com;*

[6]*The same as in 4, ORCID 0000-0002-1319-4815; piotr_pietrzak1@sggw.pl;*

1. Introduction

Universities monitor the student engagement in different areas to help them to achieve their goals, objectives, and to assess their educational offering. Engagement has also become an important issue in the understanding of student behavior and performance and addressing student needs (Christenson *et al.,* 2008). Universities that improve student engagement will benefit in terms of accreditors' assessment and competitive advantage over other universities, since it is seen to be related to academic achievements (Welch and Bonnan-Whit, 2012).

Student engagement is often considered the best predictor of student learning and development (Burch *et al.,* 2015; Schaufeli *et al.,* 2002). It is recognized as one of the major goals of the higher education institution (Haug *et al.,* 2018). The higher education institutions are accountable for creating the conditions that stimulate and support the students' learning (Zhoc *et al.,* 2019), while the students are ultimately responsible for their learning results. According to Gasiewski *et al.* (2011), the behavior and attitudes of professors is just as important as the behavior of their students in determining and sustaining engagement (An, 2015; Gasiewski *et al.,* 2011).

Student engagement can be broadly defined as the extent to which students are actively involved in meaningful educational experiences and activities (Marti, 2009). The majority of this research uses the definition of student engagement proposed by Astin (1984), who defined student engagement as "the amount of physical and psychological energy that the student devotes to the academic experience" (Astin, 1984). Student engagement is also defined as "the time and effort that students devote to educational activities, which are linked to desired outcomes" (Kuh, 2009). The latter approach has been used in this research.

The authors of this study have expanded the analysis by defining five key areas of student engagement: motivation, learning environment, institutional attachment, satisfaction, and external commitment. The conclusion of this research focuses on the possible benefits of student motivation profiling, which can be useful for understanding university policy and in practice how engagement varies across identified student groups (Krause & Coates, 2008). Understanding why students engage or not and identifying their engagement strategies should be crucial for higher education institutions' effectiveness assessment (Yee, 2016).

The objective of this research was to analyze student engagement in a group of undergraduate students in different ways. The results of the study could be used to advance the engagement theory by identifying ways of defining student engagement. The cluster study identified key features that had an impact on the student's engagement: autonomy, goal commitment, goal progress, goals setting, competence, social integration, and routinization. The main areas of the used construct concerns motivation issues, student satisfaction, and the institutional environment.

2. Literature Review

The literature on student engagement is complex and presents a wide variety of measurements and different dimensions in assessment studies. One approach to engagement reflects the quantity and quality of physical and psychological energy that students invest (Astin, 1984). It could not be achieved without student input. Nevertheless, students may fail due to personal barriers, such as a lack of intrinsic motivation or other responsibilities (Haug *et al.,* 2018).

Engagement is recognized in theories of social competence and academic achievement (Baroody, Rimm-Kaufman, Larsen, and Curby, 2016). Most of the research results are based on the U.S. National Survey of Student Engagement (NSSE) and data from the National Center for Education Statistics (NCES). However, this study was not designed strictly for investigating student engagement, revealing a gap for further study. In different countries, university student engagement is being studied based on national data sets, individually collected data, and based on formal systematic university databases.

Student engagement has also been identified as a key to understand the gradual process in a student's life that influences the final decision to stay or leave (Hart, Stewart, and Jimerson, 2011). Research suggests that an understanding of student engagement can help educators to prevent harmful outcomes and promote positive ones for at-risk students (Hart *et al.,* 2011). According to Kuh (2001), a conclusion from most of the student engagement studies is that higher levels of engagement relate to higher academic performance, lower attrition, and higher retention rates.

The research results of Burch *et al.* (2015) and Yee (2016) confirmed that student engagement is a multidimensional issue. According to Krause and Coates (2008), student engagement could be identified by seven categories, such as Transition, Academic, Peer, Student–Staff, Intellectual Online, and Beyond-Class. Four of these engagement categories (Academic, Peer, Intellectual and Beyond-Class) are directly related to the goals of the current state (Krause and Coates, 2008; Welch and Bonnan-White, 2012), which is one part of the study described here.

According to Coates's study on engagement, the construct should comprise "active and collaborative learning, participation, challenging academic environment, formative communication with academic staff, involvement in enriching educational experiences and feeling legitimated and supported by university learning communities" (Coates, 2007; Trowler, 2010). Student engagement is mostly identified in three dimensions as behavioral, emotional, and cognitive engagement.

These dimensions could be perceived as positive, non-engagement, or negative engagement (Carini, Kuh, and Klein, 2006). Most research is based on two components of student engagement: student involvement and participation (Fredricks, 2011) and behavioral engagement, which explains involvement in tasks (Heddy and Nadelson, 2012; Sinatra, Heddy, and Lombardi, 2015). Van Rooij built engagement profiles based on behavioral, cognitive, and intellectual engagement, which are related to motivation, application, performance, and environment (van Rooij, Jansen and van de Grift, 2017).

The results indicated that students with the highest behavioral and cognitive engagement scores performed better than others at the university. This attitude to engagement division was also used by Fredricks (Fredricks, 2011).

The Achievement Goals Theory highlights the personal perspective (dispositional goal orientations) and the contextual perspective or motivational climates (Gutiérrez and Tomás, 2018). According to many researchers, student engagement is positively correlated with the student's achievements (Welch and Bonnan-White, 2012). Other perspectives underline measuring the level of student engagement as the amount of energy and time that students invest in academic tasks (Kuh *et al.,* 2008).

Engaged students are incredibly resourceful and take advantage of multiple opportunities to enhance their learning (Gasiewski *et al.,* 2012). Student engagement also has many positive outcomes, such as student success and achievement, obtainment of higher grades, showing better performance during exams, feeling of a greater sense of belonging and meeting personal goals, and valuing education.

Extensive research supports the assumption that student engagement has positive effects on educational outcomes, such as increased learning, persistence, and graduation (Holliman, Martin, and Collie, 2018; Lei, Cui, and Zhou, 2018; Marti, 2009; Pascarella and Terenzini, 2005). Besides, engagement has been seen to be a good indicator of institutional quality (Christenson *et al.,* 2008).

Student engagement has been used to describe commitment and investment in learning, identification with the educational institution, participation in the institutional environment, and initiation of an activity leading to an accomplishment, associated with desired academic, social, and emotional learning outcomes (Christenson *et al.,* 2008). The student's engagement is impacted by socioeconomic circumstances, racial and ethnic backgrounds, academic preparation, and generational experience (Pascarella, Wolniak, Cruce, and Blaich, 2004; Welch and Bonnan-White, 2012).

Other significant differences in student engagement concern cultural heritage, which influences the relationship between teacher and student and impacts on the learning environment (Wang, Chen, Lin, and Hong, 2017). According to Kuh *et al.* (2008), the development of student engagement is related to the amount of energy students invest in academic and campus-based tasks and is associated with a productive academic experience (Kuh *et al.,* 2008).

Furthermore, students are less engaged at research universities and more at universities of liberal arts (Pascarella *et al.,* 2004). Also, the engagement has been studied by various authors as an important factor of students learning and institutional quality (Gordon, Ludlum, and Hoey, 2008; Gilardi and Guglielmetti, 2011).

The engagement in presented results was studied in five main areas: motivation, learning environment, institutional attachment, satisfaction, and external environment.

3. Research Methodology

3.1 Research Methods and Instruments

The evaluation process began with the students doing a self-evaluation. Then the data was analyzed in a three-stage process. The descriptive statistics and correlations between the main areas of features were calculated. The second stage, based on fuzzy logic, facilitates methods for analyzing and modeling different levels of creative tension based on individuals' perception of their current reality and vision for the future.

The creative tension describes the aspirations of the students regarding their engaging factors individually and collectively, based on the gap between the visioning of the future and the state of current reality. The third stage covered profiling the students' motivation according to a cluster method, which was performed to find out whether there were any distinct differences between the respondents (Table 1).

Table 1. *Features in the assessment system*

Area	Features	Description
		The extent that/how the students:
Motivation	Goal commitment (personal goals)	are committed to the goal of obtaining a degree and take responsibility for their studies.
	Goal progress	feel that their studies are moving forward to accomplish their goals.
	Competence (personal agency beliefs)	feel about their performance and competencies to study effectively and the attainability of goals.
	Autonomy (centralization)	feel about the degree of freedom from coercion and their influence on their study environment and decision making.
	Routinization	feel that their studies are exciting and challenging.
	Social integration (relatedness)	assess how participation and integration to a social group relates to their studies.
	Goal setting	feel about course requirements being at the right level/appropriate.
Learning environment	Responsive environment	feel the study environment is responsive to promoting effective learning.
	Learning support	feel their university is providing the support the needs for their studies.
	Learning resources	feel their university is providing conditions and resources for learning.
	Distributive justice	feel that they are treated fairly and recognized for their efforts
	Teaching quality	feel that they are receiving quality teaching at their university.
	Stressors	feel that there are things in the study environment that may cause stress.
Institutional attachment	Commitment to the institution	feel loyalty to their specific university and their intent to graduate from it.

	Emotional attachment	feel emotional attachment and connection to their specific university.
Satisfaction	Utility	recognize the future value, usability, and utility of their studies and their results.
	Student satisfaction	feel about various facets of satisfaction towards the university as a whole.
	Development	feel a sense of accomplishment and personal development.
External environment	External commitments	feel a personal bond, external to the study environment (family, community, etc.)

Source: *Own study.*

The self-evaluation method utilized in the study uses a generic, Internet-based application environment called Evolute (Kantola, 2009; 2015; Kantola *et al.,* 2011). The Evolute system contains ontology-based Internet applications that use fuzzy logic (Zadeh, 2009) to capture the subjective, abstract, and vague nature of individuals' feelings or occupational competencies (Kantola, Vanharanta, and Karwowski, 2006). The ontology is a list of attributes that describe the meta-data (i.e., the features affecting student engagement).

The ontology-based research instrument used in this study contains features that are related to student engagement, commitment, and satisfaction with the academic institution. These include attributes such as goal commitment, social integration, learning support, institutional commitment, satisfaction, and the external environment.

The Evolute approach follows a modular process involving individuals and stakeholders, where their perception and understanding of organizational or, in this case, academic resources are sought and collected with the help of statements through self-evaluation. The statements and linguistic scale values are used to assess to what extent or degree the students relate to certain issues. The research application aims to find out the current state of the students' engagement and their aspirations for the future by asking respondents to answer the statements regarding both current and desirable (target) states. The analysis comprises of student responses to 159 statements; the main areas of the investigated features are listed in Table 1.

After the evaluation, the system computes and visualizes the input data on the whole target group or sub-group levels (Kantola, 2015). The evaluation results are used to produce creative tension, i.e., the gap between the current reality and vision for the future. Often, this gap is also called proactive vision, and it is used to show possible fields of intervention. The theoretical foundation on the analysis rests on Senge's methodology, according to which evaluation of the current situation is the starting point for all future visioning (Senge, 1990). More information about the application can be found in Einolander, Vanharanta, Chang and Kantola (2016) and Einolander *et al.* (2018).

3.2 Participants

The research data was collected in the spring of the academic year 2018. The students participated voluntarily. The participants were also assured of confidentiality and

anonymity. Altogether 242 students from WULS participated in the research. The mean age of the respondents was 21.2 years of age (SD 1.77). In the respondent group, there were 98 females (mean 20.7; SD 1.43) and 98 (mean 21.5; SD 1.86) males; the rest of the respondents decided not to answer the question about their gender (mean 21.5; SD 2.01). Participation was restricted to final year's university students.

3.3 Research Hypotheses

This study was conducted to gain a deeper understanding of student engagement and the interpretation of these factors through a profiling study. The specific hypotheses of this study are:

H1: Student engagement shows a high correlation between satisfaction and the learning environment.
H2: A high level of motivation is impacted by autonomy, goal commitment, goal progress, routinization, and social integration, according to student assessment.

4. Results

4.1 Area-Level Analysis

Table 2 presents the descriptive statistics of each evaluated area from three perspectives: current state, target, and creative tension. Student engagement was mostly supported in the current state by satisfaction (0.5913), and in the case of target state assessment, this valuation was even higher. Thus, the highest creative tension was noticed in the satisfaction area (0.1227), which indicates that the gap in this field could be improved further by the university. The second area of high values for current and target states was observed for the learning environment (0.5815 and 0.6992, respectively).

Table 2. *Descriptive statistics. Mean (M), standard deviation (SD)*

Area of features	Current state		Target state		Creative tension	
	M	**SD**	**M**	**M**	**SD**	**M**
Motivation	0.5736	0.1269	0.6819	0.1304	0.1083	0.1117
Learning environment	0.5815	0.1414	0.6992	0.1397	0.1177	0.1302
Institutional attachment	0.5763	0.1577	0.6594	0.1506	0.0830	0.1108
Satisfaction	0.5913	0.1684	0.7140	0.1554	0.1227	0.1512
External commitments	0.4957	0.1467	0.5183	0.1620	0.0226	0.1061

Source: *Own study.*

Table 3 shows the correlations between the main areas of evaluation of student engagement for the current state. A few significant and strong relationships were found between satisfaction and the learning environment (0.853), which reflects the role of the university and possible improvements in their teaching programs. The second highest robust correlation was noticed between satisfaction and institutional attachment (0.837).

However, a weaker relationship was observed between all areas and the external environment, which implies that student engagement is not directly related to other areas and could be investigated separately.

Table 3. *Correlations matrix for the current state*

1	Motivation	–				
2	Learning environment	.799*	–			
3	Institutional attachment	.692*	.722*	–		
4	Satisfaction	.782*	.853*	.837*	–	
5	External environment	.239*	.290*	.361*	.406*	–
		1	2	3	4	5

*Note: * Correlation is significant at the 0.05 level (two-tailed).*
Source: Own study.

Table 4 shows the correlations between the main areas of student engagement evaluation for the target state. A strong relationship was noticed between satisfaction and the learning environment (0.857), like that of the current state (0.853). However, the second strongest relationship concerns motivation and the learning environment (0.857). It shows the crucial role of the university in creating a high level of motivation. The weakest correlations were between the external environment and other variables. This level was even lower than in the current state assessment.

Table 4. *Correlations matrix for the target state*

1	Motivation	–				
2	Learning environment	.857*	–			
3	Institutional attachment	.684*	.735*	–		
4	Satisfaction	.806*	.881*	.809	–	
5	External environment	.112	.067	.313*	.153*	–
		1	2	3	4	5

*Note: * Correlation is significant at the 0.05 level (two-tailed).*
Source: Own study.

Table 5 shows the correlations between the main areas of evaluation for the tension state. The most robust relationship between the constructs was noticed in the same area as in the case of the target state (level of correlation (0.822). It showed that the satisfaction and learning environment area were strongly correlated in the case of the current state. It explained the level of university impact on student satisfaction and, consequently, on their engagement. In the case of target and tension correlation, the second relationship was also important and concerned motivation and the learning environment. This reflects the essential role of the university in increasing student motivation and, thus, their engagement. None of the features were negatively correlated.

Table 5. *Correlations matrix for the tension state*

1	Motivation	–				
2	Learning environment	.822*	–			

3	Institutional attachment	.580*	.669*	–		
4	Satisfaction	.757*	.822*	.687*	–	
5	External environment	.113	.148*	.253*	.111	–
		1	2	3	4	5

**Note:** *Correlation is significant at the 0.05 level (two-tailed).*
Source: *Own study.*

4.2 Feature-Level Analysis

Figure 1 presents the feature-level analysis taken from the Evolute system. The figure displays the collective current and target state values and their standard deviations. The blue bars illustrate the standard deviation of the current state values and the red bars the target state values, and the lines represent their mean. The figure is sorted based on the creative tension values. According to Figure 1, the respondents felt the highest creative tension, i.e., the desire for change, in routinization (excitement and challenge gained from the studies), learning support (adequateness of the support the university provides), competence (feelings of performance and competency to study), development (feelings of accomplishment and personal development), and teaching quality.

Based on the creative tension results, the respondents think that the studies should provide more variety and be more challenging and stimulating. The respondents also felt the university should provide them with more support, for example, by communicating, sharing information, giving feedback, and encouraging the students. In addition, the respondents collectively felt they would like to advance their study-related skills and capabilities. Also, creative tension was quite high in teaching quality. This feature assesses the quality, consistency, professionalism, and interestingness of the teaching staff and methods, for example. Based on this result, the respondents felt the teaching styles should be more stimulating to sustain their attention and interest.

Figure 1. *Variation analysis of feature-level results and their standard deviations*
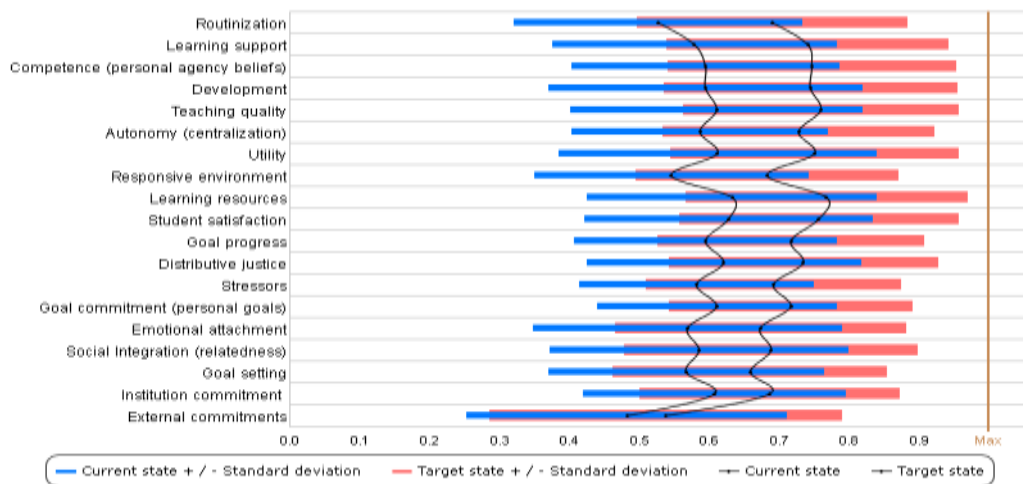
Source: *Own study.*

Figure 2 presents the results arranged based on the target state evaluations. In the target state evaluation, the respondents express their desires and feelings according to their current situation and knowledge. The results of the target state evaluations highlight how the respondents value each feature; in other words, which ones they think are the most important. Based on these results, the respondents value learning resources, teaching quality, and their feelings of satisfaction at the highest level.

Figure 2. *Current and future state analysis*
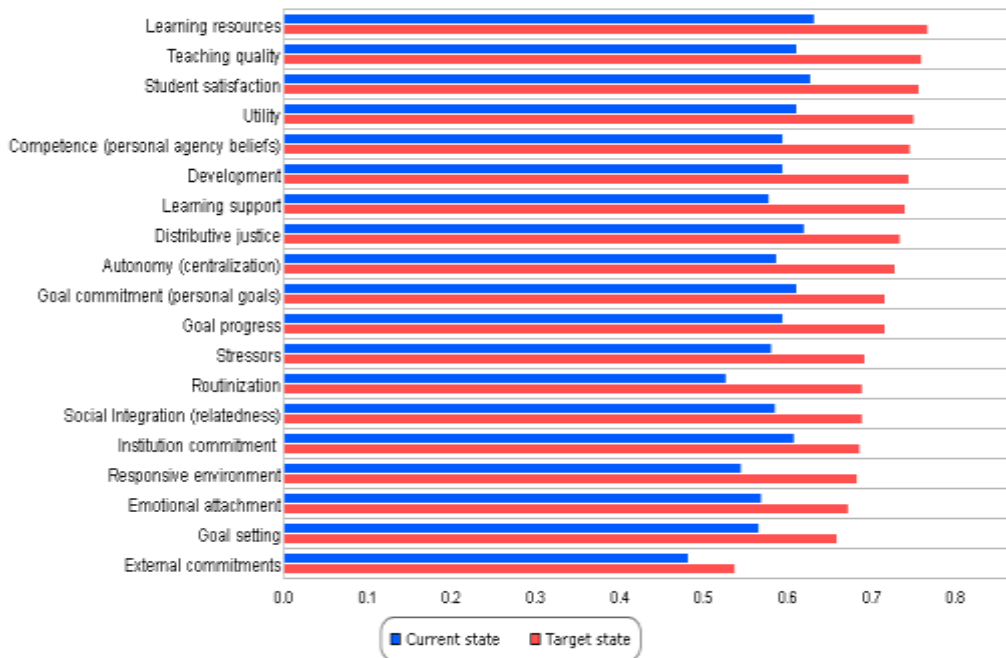
Source: Own study.

4.3 Cluster Analysis

Cluster analysis was performed to find out whether there were any distinct differences between the respondents regarding their motivation. By using cluster analysis, motivational profiles were created. Motivation is one of the key factors affecting student engagement. For students to be engaged and motivated to learn, core psychological variables related to motivation, such as competence and control, beliefs about the value of education, and a sense of belonging must be fulfilled (Youth and Studer, 2004).

This analysis used K-means clustering to examine the variables related to study motivation and combine motivation profiles from the assessment data. In contrast to simply looking at different variables of motivation separately, this analysis was carried out to identify different profiles among the respondents with various amounts of variables related to motivation. K-means clustering is a type of unsupervised learning with the goal of finding groups in the data, with the number of groups represented by the variable K. K-means clustering can be used in business research to confirm business assumptions

about what types of groups exist or identify unknown groups in complex data sets (Trevino, 2016). It is a non-hierarchical data analysis technique, which uses an algorithm to partition individual cases into a pre-specified number of clusters based on their values, in a manner that maximizes between-cluster differences and minimizes within-cluster variance. Table 6 presents the cluster analysis results.

Table 6. *Cluster analysis results*

|	**Cluster**		
	1	**2**	**3**
Zscore: Autonomy (centralization)	-.12194	.97728	-1.15007
Zscore: Goal commitment (personal goals)	-.12920	.96992	-1.11725
Zscore: Goal progress	-.14958	1.06392	-1.20231
Zscore: Goal setting	-.12998	.78277	-.82570
Zscore: Competence (personal agency beliefs)	-.06535	.87378	-1.15731
Zscore: Social Integration (relatedness)	-.11895	.91829	-1.06774
Zscore: Routinization	-.16552	.95709	-.99009

Source: *Own study.*

In this analysis, the items in the motivational categories were firstly summed into scale scores, after which they were standardized (z-scores) and used for k-means cluster analysis. The clusters were obtained by first using exploratory hierarchical clustering using Ward's method to define the optimal number of clusters, and then using k-means clustering to form the actual clusters. A three-cluster solution was used as it provided the clearest distinct profiles. Figure 3 illustrates the three profiles (clusters). K-means clustering is considered confirmatory, as it requires prior conception about the numbers of clusters that are expected to emerge in the sample.

Based on Figure 3, there are three quite distinct profiles that display the means of the motivation scales. As can be seen in Figure 3, in Cluster 1, all the motivation categories are well above the mean values. These respondents can be considered "highly motivated". Cluster 2 is slightly below the averages in all the motivation categories; these individuals can be considered "neutrally-moderately motivated". In contrast, in Cluster 3, all the engagement categories are well below the mean. Based on this analysis, these individuals can be considered "poorly motivated". Based on the p-value, the cluster differences were statistically significant ($\alpha=0.01$).

When considering how many respondents are within each category, it seems that most people fall into the neutrally/moderately motivated category (n=130, 54%). The second most students are in the highly motivated group (n=68, 28%), and the rest are in the poorly motivated category (n=44, 18%).

Figure 3. *Three clusters of student engagement*
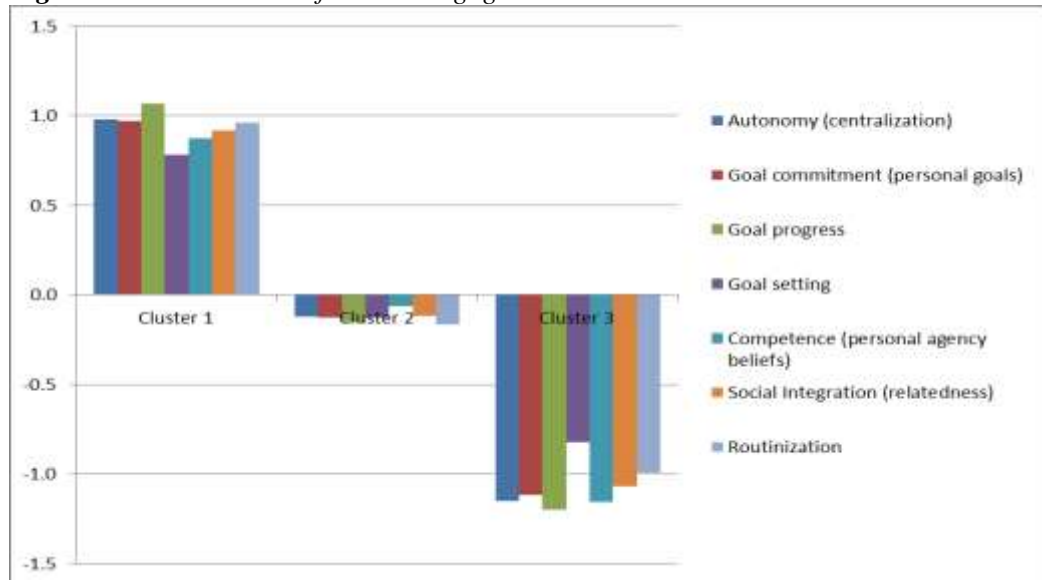
Source: Own study.

5. Discussion

From the research findings, it can be concluded that student engagement is influenced by many factors. Further analysis of the features assigned to each area of the ontology was included in the study. The results indicate that the highest engagement was related to the level of student' satisfaction and the learning environment. The results also confirmed the research results of Kuh *et al.* (2008) and Welch and Bonnan-White (2012), who investigated students' level of performance along with engagement.

This also supports the statement that learning results are stimulated by lecturers who support students' learning (Zhoc *et al.,* 2019). Overall, Hypothesis 1 was supported. Students' high satisfaction was explained by the higher student engagement, which correlated highly to their evaluations of the learning environment.

Cluster analysis promotes the use of obtained data to classify students into different groups when trying to obtain insights from the students, to see whether they feel that their study environment is motivating and whether they feel motivated to study in their educational institution. In this analysis, participants cannot be identified from the results, but it could be done if students answered using their real names. In that case, the results could be used to create more individual/group specific practices.

This kind of information would give the management of higher education institutions better chances to try to influence their students' motivation more effectively by creating specific motivation-enhancing activities. The cluster method revealed the features from the motivation category that had the highest significant differences between the group of students who were classified as strongly motivated, neutrally-moderately motivated, and poorly motivated according to K-means clustering.

The need for understanding the multi-motivational structure also underline Bråten and Olaussen (2005) to identify factors that impact on high levels of motivation across the academic year. Through understanding the factors that were responsible for creative tensions in student engagement, it was possible to distinguish three clusters.

Cluster 1 (highly motivated) showed high values in autonomy, goal commitment, goal progress, routinization, and social integration. The feature of goal setting also had high values but slightly lower than the ones mentioned earlier. Cluster 2 (neutrally-moderately motivated) showed values a little below the mean in all features. The highest number of students fell into this category. Cluster 3 (poorly motivated) had low values in all the features. The lowest values were in autonomy, goal commitment, goal progress, competence, and social integration. The feature of goal setting had the highest negative value in Cluster 3.

Hypothesis 2 was supported based on the cluster analysis results. The development of a student engagement profile appears to be a sensitive context issue for university development. These study results are also confirmed by Welch and Bonnan-White (2012), Bailey and Phillips (2016), Pascarella et al. (2004) and Zepke and Leach (2010).

6. Conclusions, Limitations of the Study, and Further Directions

Based on the student evaluations, further university interventions can be planned. Examining the thoughts and emotions the students have related to their studies and study environment enables university management to make plans to improve their study programs and study environment.

In addition, the students may learn more about themselves and their motivations. The method can be used to support students' long-term engagement towards their studies and their educational institute and help to analyze drop-out problems. The study contributes to the theory of student engagement, going beyond the widely studied reasons and personal assessment of possible future changes.

Because of the limited sample size of the students, the results cannot be generalized to a larger population. A representative sample design of all students could not be collected in this research. Regarding the limitations of the study, the lack of proportionality between groups in the present study underscores the importance of different research approaches to student engagement between Bachelor and Master's degree students.

Future studies could investigate the structural contribution of student engagement evolution across PLS regression methods to assess which constructs of the presented approach impact each other.

References:

An, B.P. 2015. The role of academic motivation and engagement on the relationship between dual enrolment and academic performance. The Journal of Higher Education, 86(1), 98-126. http://dx.doi.org/10.1080/00221546.2015.11777358.

Astin, A. 1984. Student Involvement: A Developmental Theory for Higher Education. Journal of College Student Personnel, 25(4), 297-308.

Bailey, T.H., Phillips, L.J. 2016. The influence of motivation and adaptation on students' subjective well-being, meaning in life and academic performance. Higher Education Research and Development, 35(2), 201-216. https://doi.org/10.1080/07294360.2015.1087474.

Baroody, A.E., Rimm-Kaufman, S.E., Larsen, R.A., Curby, T.W. 2016. A multi-method approach for describing the contributions of student engagement on fifth grade students' social competence and achievement in mathematics. Learning and Individual Differences, 48, 54-60. https://doi.org/10.1016/j.lindif.2016.02.012.

Bråten, I., Olaussen, B. 2005. Profiling individual differences in student motivation: A longitudinal cluster-analytic study in different academic contexts. Contemporary Educational Psychology – Contemp Educ Psychol., 30. 359-396. 10.1016/j.cedpsych.2005.01.003.

Burch, G.F., Heller, N.A., Burch, J.J., Freed, R., Steed, S.A. 2015. Student Engagement: Developing a Conceptual Framework and Survey Instrument. Journal of Education for Business, 90(4), 224-229. https://doi.org/10.1080/08832323.2015.1019821.

Carini, R.M., Kuh, G.D., Klein, S.P. 2006. Student engagement and student learning: Testing the linkages. Research in Higher Education, 47(1), 1-32. https://doi.org/10.1007/s11162-005-8150-9.

Christenson, S.L., Reschly, A.L., Appleton, J.J., Berman, S., Spanjers, D., Varro, P. 2008. Best practices in fostering student engagement. Best Practices in School Psychology, 5, 1099-1120. National Association of School Psychologists Bethesda, MD.

Coates, H. 2007. A model of online and general campus-based student engagement. Assessment and Evaluation in Higher Education, 32(2), 121-141. https://doi.org/10.1080/02602930600801878.

Einolander, J., Vanharanta, H., Chang, Y.S., Kantola, J. 2016. Comparing university students' commitment – a multicultural case study. Theoretical Issues in Ergonomics Science, 17(3), 267-283. https://doi.org/10.1080/1463922X.2015.1093671.

Einolander, J., Vanharanta, H., Kantola, J., Paliszkiewicz, J., Mądra-Sawicka, M. 2018. A Comparative Study of Student Engagement in two Polish Universities. Zeszyty Naukowe Politechniki Poznańskiej Organizacja i Zarządzanie, (76), 87-98. https://doi.org/10.21008/j.0239-9415.2018.076.06.

Exley, K., Dennick, R. 2009. Giving a lecture: From presenting to teaching. Journal of Chemical Information and Modeling, (53). New York, Routledge. https://doi.org/10.1017/CBO9781107415324.004.

Fredricks, J.A. 2011. Engagement in school and out-of-school contexts: A multidimensional view of engagement. Theory into Practice, 50(4), 327-335. https://doi.org/10.1080/00405841. 2011.607401.

Gasiewski, J.A., Eagan, M.K., Garcia, G.A., Hurtado, S., Chang, M.J. 2012. From Gatekeeping to Engagement: A Multicontextual, Mixed Method Study of Student Academic Engagement in Introductory STEM Courses. Research in Higher Education, 53(2), 229-261. https://doi.org/10.1007/s11162-011-9247-y.

Gilardi, S., Guglielmetti, C. 2011. University life of non-traditional students: Engagement styles and impact on attrition. The Journal of Higher Education, 82(1), 33-53. http://dx.doi.org/10.1080/00221546.2011.11779084.

Gordon, J., Ludlum, J., Hoey, J.J. 2008. Validating NSSE against student outcomes: Are they related? Research in Higher Education, 49, 19-39.

Gutiérrez, M., Tomás, J.M. 2018. Motivational Class Climate, Motivation and Academic Success in University Students. Revista de Psicodidactica, 23(2), 94-101. https://doi.org/10.1016/j.psicod.2018.02.001.

Hart, S.R., Stewart, K., Jimerson, S.R. 2011. The Student Engagement in Schools Questionnaire (SESQ) and the Teacher Engagement Report Form-New (TERF-N): Examining the Preliminary Evidence. Contemporary School Psychology, 15(1), 67-79. Retrieved from http://www.casponline.org/pdfs/pdfs/2011_journal_all_001-144-b.pdf#page=69.

Haug, J.C., Berns Wright, L., Allen Huckabee, W. 2018. Undergraduate business students' perceptions about engagement. Journal of Education for Business, 94(2), 81-91. https://doi.org/10.1080/08832323.2018.1504738.

Heddy, B.C., Nadelson, L.S. 2012. A Global Perspective of the Variables Associated with Acceptance of Evolution. Evolution: Education and Outreach, 5(3), 412-418. https://doi.org/10.1007/s12052-012-0423-0.

Holliman, A.J., Martin, A.J., Collie, R.J. 2018. Adaptability, engagement, and degree completion: a longitudinal investigation of university students. Educational Psychology, 38(6), 785-799. https://doi.org/10.1080/01443410.2018.1426835.

Kantola, J., Karwowski, W., Vanharanta, H. 2011. Managing managerial mosaic: the Evolutemethodology. In: Electronic Globalized Business and Sustainable Development Through IT Management: Strategies and Perspectives, 773-789.

Kantola, J. 2009. Ontology-based resource management. Hum. Factors Ergon. Manuf. Serv. Ind. 19(6), 515-527.

Kantola, J. 2015. Organizational Resource Management: Theories, Methodologies, and Applications. CRC Press.

Kantola, J., Vanharanta, H., Karwowski, W. 2006. The evolute system: A co-evolutionary human resource development methodology.

Krause, K.L., Coates, H. 2008. Students' engagement in first-year university. Assessment and Evaluation in Higher Education, 33(5), 493-505. https://doi.org/10.1080/02602930701698892.

Kuh, G.D. 2001. Assessing What Really Matters to Student Learning Inside the National Survey of Student Engagement. Change: The Magazine of Higher Learning, 33(3), 10-17. https://doi.org/10.1080/00091380109601795.

Kuh, G.D. 2009. What student affairs professionals need to know about student engagement. Journal of College Student Development, 50(6), 683-706. https://doi.org/10.1353/csd.0.0099.

Kuh, G.D., Cruce, T.M., Shoup, R., Kinzie, J., Gonyea, R.M. 2008. Unmasking the Effects of Student Engagement on First-Year College Grades and Persistence. The Journal of Higher Education, 79(5), 540-563. https://doi.org/10.1080/00221546.2008.11772116.

Lei, H., Cui, Y., Zhou, W. 2018. Relationships between student engagement and academic achievement: A meta-analysis. Social Behavior and Personality, 46(3), 517-528. https://doi.org/10.2224/sbp.7054.

Marti, C.N. 2009. Dimensions of student engagement in american community colleges: Using the community college student report in research and practice. Community College Journal of Research and Practice, 33(1), 1-24. https://doi.org/10.1080/10668920701366867.

Pascarella, E.T., Terenzini, P.T. 2005. How College Affects Students: A Third Decade of Research I(2). Indianapolis, Wiley.

Pascarella, E.T., Wolniak, G.C., Cruce, T.M., Blaich, C.F. 2004. Do Liberal Arts Colleges Really Foster Good Practices in Undergraduate Education? Journal of College Student Development, 45(1), 57-74. https://doi.org/10.1353/csd.2004.0013.

Petersen, I.H., Louw, J., Dumont, K. 2009. Adjustment to university and academic performance among disadvantaged students in South Africa. Educational Psychology, 29(1), 99-115. https://doi.org/10.1080/01443410802521066.

Schaufeli, W.B., Martínez, I.M., Pinto, A.M., Salanova, M., Barker, A.B. 2002. Burnout and engagement in university students a cross-national study. Journal of Cross-Cultural Psychology, 33(5), 464-481. https://doi.org/10.1177/0022022102033005003.

Senge, P. 1990. The art and practice of the learning organization. New York, Doubleday.

Sinatra, G.M., Heddy, B.C., Lombardi, D. 2015. The Challenges of Defining and Measuring Student Engagement in Science. Educational Psychologist, 50(1). https://doi.org/10.1080/00461520.2014.1002924.

Stoeva, P., Pitas, J. 2018. Military Students Motivation: Comparative Analysis in Economics and Management, 40-48. Brno, University of Defence/Czech Republic.

Trevino, A. 2016. Introduction to K-means clustering. Retrieved from: http://datascience.com.

Trowler, V. 2010. Student engagement literature review. Higher Education, (11), 1-15. Retrieved from: http://americandemocracy.illinoisstate.edu/documents/ democratic-engagement- white-paper-2_13_09.pdf.

van Rooij, E.C.M., Jansen, E.P.W.A., van de Grift, W.J.C.M. 2017. Secondary school students' engagement profiles and their relationship with academic adjustment and achievement in university. Learning and Individual Differences, 54, 9-19. https://doi.org/10.1016/j.lindif.2017.01.004.

Virtanen, T.E., Lerkkanen, M.K., Poikkeus, A.M., Kuorelahti, M. 2014. Student behavioral engagement as a mediator between teacher, family, and peer support and school truancy. Learning and Individual Differences, 36, 201-206. https://doi.org/10.1016/j.lindif.2014.09.001.

Wang, H.H., Chen, H.T., Lin, H.S., Hong, Z.R. 2017. The effects of college students' positive thinking, learning motivation and self-regulation through a self-reflection intervention in Taiwan. Higher Education Research and Development, 36(1), 201-216. https://doi.org/10.1080/07294360.2016.1176999.

Welch, B.K., Bonnan-White, J. 2012. Twittering to increase student engagement in the university classroom. Knowledge Management and E-Learning, 4(3), 325-345.

Yee, A. 2016. The unwritten rules of engagement: Social class differences in undergraduates' academic strategies. The Journal of Higher Education, 87(6), 831-858. http://dx.doi.org/10.1080/00221546.2016.11780889.

Youth, M., Studer, S. 2004. Engaging Schools: Fostering High School.
Students' Motivation to Learn. National Academy Press, Washington.

Zadeh, L.A. 2009. Toward extended fuzzy logic–a first step. Fuzzy Sets and Systems, 160(21), 3175-3181. Elsevier.

Zepke, N., Leach, L. 2010. Improving student engagement: Ten proposals for action. Active Learning in Higher Education, 11(3), 167-177. https://doi.org/10.1177/1469787410379680.

Zhoc, K.C.H., Webster, B.J., King, R.B., Li, J.C.H., Chung, T.S.H. 2019. Higher Education Student Engagement Scale (HESES): Development and Psychometric Evidence. Research in Higher Education, 60(2), 219-244. https://doi.org/10.1007/s11162-018-9510-6.