Clustering Different Learning Behavior with Model of Culture

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Abstract

Culturally based habits and expectations influence learning. Identifying these cultural expectations is a prerequisite for designing learning environments that best serve students. This research studied the behavior of university students in the greater Jakarta area using the model of culture. The model of culture was an extension from Hall's model, and consists of eight dimensions, i.e., time focus, time orientation, power, competition, action, space, communication, and structure. 1207 responses from different universities in the greater Jakarta area were collected and analyzed using two-stage cluster analysis (combination of Ward method and K-means clustering). The result shows three clusters, namely: the millennial engineers, the diffused social studies students, and the silent achiever. Different teaching tools were then suggested for each cluster to address their weaknesses and strengths.

Keywords
Culture, Education, Learning, Model of Culture, Edgar Hall

1. Introduction

Culture influences our way of life, including in the education sector. Culture can influence the way students share information and skills amongst their peers (Alothman *et al.*, 2017). In the context of higher education, students have the opportunity to develop their social skills allowing them to learn beyond just technical competencies (Farber, 2014). In addressing their long-term plans, it is crucial for students to acquire the right aspect of culture and how to deal with other people (Zabadi and Al-Alawi, 2016). To make students better prepared for professional work, it is important to address soft skill and social growth in addition to academic growth (Rigden, 2019). Without the right cultivated culture, student learning can lead to dropouts that can impact long term educational goals (Abdul Kareem Al-Mansoob, 2018). On the contrary, positive culture building during the learning process can stimulate more gain for both teachers and students (Chen, 2018). Culture of peer coaching can be crucial to give better exposure and dealing with tasks during the learning process. Students with an open culture embrace more new innovations in the learning process (Mazur, 2010).

The inherited culture from students' backgrounds also plays an important role. For example, in collectivist culture, a sense of trust within society triggers an initiative to pull resources into a shared purpose (Yakaboski *et al.*, 2017). In the end, the students' cultural background and the culture of the schools they attend influence the quality of learning experiences (O'Sullivan *et al.*, 2019). This makes it necessary to embrace diversity in the teacher's composition (Keane and Heinz, 2016; Villegas and Irvine., 2010).

With the advancement of technology, students' behavior in the learning process has formed different cultural behavior and habits (Spathopoulou, 2019). With e-learning platforms, students' opportunities become wider and beyond spatial, social and economic constraints (Zabadi and Al-Alawi, 2016).
Attention and transformation have been done in the education field to address quality, equity, and diversity. Creative teaching strategies must be developed to address diversity inherited in students' needs. This will

minimize barriers during the learning and participation process, and optimizing learning process (Manuel and Tome, 2021).

Previous studies have been done to address a constant changing need of students, such as done by Manuel and Tome (2021) to address special needs as a new way of education, Spathopoulou (2019) who studied gamified learning to enhance student acceptance from a culture point of view.

Looking at the opportunity to address different needs of students, the objective of this study was to investigate underlying cultural behavior of students and cluster them to identify their different needs and address possibilities for improvement in their learning process. The study was limited only to university students in the greater Jakarta area.

2. Literature Review

2.1. Role of Cultures in Learning Process

According to Hofstede, culture is the collective mental programming of a group of people (Browaeys and Price, 2015). Nevertheless, it is learnt and not inherited, and different from human nature and individual personality (Gheorghe, 2014).

Although culture is most of the time associated with a nation, it can also be associated with profession and domain of study. For example, accountants and people dealing with quality control tend to have a monochronic culture derived from the required behavior of their domain of expertise.

Villegas-Mateos *et.al.* (2021) argues the importance of culture as determinant in some fields of study such as entrepreneurship programs. The increasing awareness of necessity for entrepreneurship in education has triggered research related to this. Examples are the one done by Bamber and Elezi (2020) who investigate the role for teaching entrepreneurship while at the same time assess the university culture using Quinn's (1988) organizational culture. Similar study was done by Oldham (2018) for higher education in New Zealand.

Another study by Sikkema and Sauerwein (2014) investigated the impact of culture on learning, in particular in the domain area of accounting, and the importance of culture-specific learning for accounting educators. While Singh and Chaudhary (2015) dedicated research on developing a learning culture that enhances creativity in students.

In a nutshell, previous research exploring culture-specific learning styles does exist (Sikkema and Sauerwein, 2014), although they are not static as indicated by Marriott (2002) who highlighted changes of learning style preference over time. For this reason, educators should take into account student adaptability into teaching and learning process and should offer diverse opportunities in promoting student engagement into the teaching content.

2.2. From Edgar Hall's Cultural Dimension to Model of Culture

Many Cultural studies pioneers acknowledge the role of communication in cultural dimensions (Hall, 1976; Hofstede, 1980, 2001; House *et al.*, 2004; Schwartz, 1992; Trompenaars, 1993). Nevertheless, only Hall includes communication explicitly to culture dimension since he believes that culture is communication, and no communication can be separated from culture (Hall, 1992). Together with Hofstede and Trompenaars, Edgar Hall's cultural models are the three most popular models (Dimitrov, 2014).

Edgar Hall's cultural dimension emphasizes patterns of communication, reflected by group's sharing the same culture based on how they see and analyze reality (Hall, 1976). His work on cultural dimension comes from his exposure working at Native American Indian Reservations before World War II, where he learnt first-hand experience on complexity in intercultural relations (Hall, 1992). Indeed, Eastern Cultures prefer to use non-verbal communication style (high context) compared to Western culture. This High context-low-context behavior manifested into their conflict management style (Guirdham, 1999; S. Ting-Toomey and Oetzel, 2002; Stella Ting-Toomey, 2012).

Over more than 200 articles have been published with stress on Hall's "Context" culture, such as done by Warner-Søderholm (2013) in Norway. Despite a lot of studies, relating Hall's context dimension to nations' culture, Kittler *et al.* (2011) argued that it is limited and not supportive with strong evidence.

Edgar T. Hall introduced his first work "The Silent Language" in 1959, based on Freud theory, addressing non-verbal communication behavior in culture. In his first publication, he introduced three culture dimensions: time,

space and context (Hall, 1959). In his later publications (Hall, 1976, 1983) he elaborated correlation amongst these three dimensions. According to Hall, humans need to go beyond culture in order to exploit more creative, expansive and responsive ways in using our under-developed capacity to think, communicate and resolve problems (Hall, 1976; Tool, 1977). He then suggested that individuals combine pre-programmed elements based on culture-specific context and information to create meaning.

Browaeys and Price (2015) elaborated the model of culture based on Walker et. al. (1992), which amended Hall's culture dimension into a model aiming for doing business in international context, and propose 8 dimensions, as following:

- ***Time Focus (monochronic vs. polychronic)***: refers to how members of a culture perceive time. Monochronic culture aims to "keep time" and tend to perform one-task at a time. Polychronic culture can be multi-tasking, as they perceive doing parallel tasks as "using time".
- ***Time Orientation (past, present, and future)***: refers to how one puts emphasis on time. Culture concerned with the present prefers quick and short-term results. Those with a view towards the future are willing to give up short-term gain in lieu of long-term benefits.
- ***Power (hierarchy vs equality)*** : refers to the extent to which the less powerful members of the culture expect and accept that power is not distributed equally. In a "hierarchy" society, teachers are expected to behave in ways that reinforce their importance, while in a "equality" society, teachers show participative or consultation style.
- ***Competition (competitive vs. co-operative)***: refers to whether a society puts individual goals vs collective (team) objectives. A Competitive culture emphasizes on performance and allows the winner to take all, while co-operative culture prefers relationships in the process.
- ***Action (doing vs. being)***: refers to preference on whether a society values what we do against who we are. In the context of education, in a "doing" society, teachers are valued if they have expertise and competence, while in a "being" society, they are considered to be effective if their personal philosophy, value and style are seen as compatible.
- ***Space (private vs public)***: refers to how different cultures define and organize their space at an unconscious level. In cultures with a more specific nature, they have larger public spaces where personal matters are openly discussed, and family worries and individuals' failings can be revealed to all. Nevertheless, their private space is very small and not easily penetrated. On the contrary, a diffuse culture is the one with smaller and more formal public space and not easily entered by strangers. But once they accept someone, then the person will be given access to a larger private sphere.
- ***Communication (high-context vs. low-context).*** Context refers to the nature of how meaning is constructed differently across cultures based on different ratios of context and information. In low-context culture most meanings are shown explicitly (read-on the line), while in high-context culture meanings are shown implicitly (read between the line).
- ***Structure (individualism vs. collectivism)***: refers to a social structure which allows a society to distinguish uncertain situations, ambiguity, stress and risk. This dimension is similar to the dimensions in Hofstede and Trompenaars.
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Browaeys and Price (2015) proposed this model of culture as a framework for managers to deal with diverse culture differences in international business context. They elaborate how each of the eight dimensions influence how managers perform the five general management tasks. In this sense, we can conclude that the model of culture is also universal in nature and hence can be felt and experienced in everyday life, including in education. It also evolved from Edgar Hall's three dimensions related to communication, which is relevant in a teaching-learning environment. For example, an individual's communication styles may influence which subject he/she chooses in university. For these reasons, we proposed to use the model of culture as a framework or basis for clustering different learning behavior for students.

3. Methods and Data Collection

One of the methods to group data into a meaningful interpretation is using cluster analysis. With this method, objects/data are clustered based on similarities with groups, while taking into account dissimilarities between the resulting clusters (Maholtra and Birks, 2010). Cluster analysis has been used in various areas and applications, although it is mostly popular in marketing research (Djokic *et al.*, 2013; Li and Sun, 2018; Wu *et al.*, 2016).
There are two broad ranges of cluster analysis, namely partitioning and non-partitioning approaches, each having their own pros and cons. The most popular partitioning approach is the ward method using Agglomerative Hierarchical Clustering (AHC). This method gives recommendations on the number of clusters required, although most scholars highlighted its drawback in terms of accuracy against outliers and large data sets. The most popular non-partitioning approach is K-Means clustering, which is considered more suitable for large data sets, but users must specify the number of clusters to be investigated (Gan *et al.*, 2007; Hair *et al.*, 2014). To bridge the gap, two

stage clustering methods can be applied. In this method, we first run AHC to get the suggested number of clusters, and then follow with K-Means clustering (Kosasih *et al.*, 2017; Tafreshi *et al.*, 2014), which we adopt in this research.

Although Cluster analysis is simple, it is nonetheless an exploratory approach. Therefore, validating the cluster analysis can be a little bit tricky. One way to do it is by measuring the compactness and separability of the clusters (Liu *et al.*, 2010). Nevertheless, the best number of clusters depends on the interpretation of solutions by each user (Blashfield and Aldenderfer, 1988). Despite its strength and weakness, cluster analysis remains a powerful analysis tool, provided the result can be understood and interpretation fits with the perceived phenomenon. With cluster analysis, the scattered data is grouped with statistical methods which help analysts make sense of the interpretation. In this study, we were using this method to help us investigate whether the collected data can somehow fit into several clusters using cultural dimension from the model of culture as the base for clustering.

The research is descriptive cross-sectional analysis using samples from several university students in the greater Jakarta area. with the following elaboration:

- Literature Review was performed aiming to select suitable theory/framework on Cultural Dimensions. Few cultural frameworks were investigated to select the one relevant to address diversity in the learning environment.
- Design Questionnaire to address the selected cultural dimension. The next step was to design a questionnaire to measure the score of each of the eight cultural dimensions. Twenty-four questions were asked in the questionnaire, upon which respondents need to give their response. For each question respondents were asked to give their preference to the two extremes (e.g., monochronic vs polychronic) and stated the scale using 1-3-5 scale. Table 1 illustrates the questionnaire.
- Data Collection. Sampling was done using non-probabilistic, convenience and snowball sampling type. The questionnaire was distributed using google form to different major universities in the greater Jakarta area. The questionnaire was distributed to private universities which have more, and diverse students compared to typical Indonesian state universities. When distributing the questionnaire, we also regularly monitor the response to make sure we got a decent and diverse proportion in terms of year of studies and major taken by the respondents, since we suspect these respondent profiles can help in data analysis.
- Calculate number of clusters using ward method with the Agglomerative Hierarchical Clustering (AHC) technique. Responses of all cultural dimensions from all respondents were analyzed to get the suggested number of clusters.
- Perform the clustering analysis with K-Means Cluster method, using suggested number of clusters from previous step,
- Perform analysis, discussion points and suggestions based on the result.

Table 1: List of Questions in Questionnaire

	SIDE A	-5	-3	-1	1	3	5	SIDE B		
Low Context	Read the textbook is more important than listening teacher's explanation in class							Listening to teacher's explanation in class is more important than reading the textbook	High Context	Communication
	Written exam is the best way to evaluate students							Class participation should be teacher consideration in grading		
	In doing group work, it is very important to clearly divide the work.							In doing group work, it is very important for each member to participate and contribute		
Individuali	I am more effective when studying by myself							I am more effective when studying in group	Collectivi	Structure
	The best teacher is the one who encourage us to explore by ourselves (e.g. from the book)							The best teacher is the one who can make use understand in class		
	Individual assignments make me understand better							Group assignments make me understand better		

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Hierarchy	In group work, it will be more efficient to assign a leader.							In a group work, it will be more efficient if everybody can freely contribute	Equality	Power
	Teacher has to supervise and make sure student to learn							Students need to study by themselves		
	Teachers need to master all the materials							It is normal if not all material is mastered by the teacher		
Past	I prefer to choose field of study that I like							I prefer to choose field of study that will be important/ needed in the future	Future	Timeorientation
	In group assignment, I prefer to be with the same people that has proven effective in the past in groupwork							In group assignment, new member can give new ideas		
	To get better result, I studied from past exams materials							To get better result, I study current materials and new development		
Competition	Grading components should have more weight on written exam.							Grading components should have more weight on group works/assignment	Cooperative	Competition
	High GPA is important for my career after university							Having more friends and network is important for my career after university		
	In class, I prefer to sit in the front row (so I can listen better)							In class, I prefer to sit amongst my friends		
Doing	It is very important to get a good grade							It is very important to understand to content of the lecture	Being	Action
	To get higher grade, we need to study hard							To get higher grade, we need to like the subject		
	A good teacher is the one expert in the subject							A good teacher is the one who can explain the subject		
Public	Teacher must be able to mingle with students							Teacher is better to have separate rooms and be respected	Private	Space
	In doing a group work, we better brainstorm first, then read the material							In doing a group work, we better read first, then brainstorm.		
	Teacher is preferred to announce grading of each student to the whole class							Teacher should give grading information only to each respected student		
Monochronic	Assignment should be informed ahead of time to make better preparation							Assignment should be distributed only when its ready and complete	Polychronic	Timefocus
	It is very important to be on-time in group-work							It is very important to involve everybody in group work		
	To have a smooth study, it is important to study hard							To have a smooth study, student need to know bureaucracy process in the university		

4. Results and Discussion

4.1. Respondent Profiles

The questionnaire was then distributed to several university students in the Greater Jakarta Area using convenience and snow-ball sampling. 1207 responses were collected, with profiles displayed in Figure 1.
The respondents are equally split between male and female. Sixty four percent of the respondents have GPA above three, with twenty seven percent having between 2.5 and 3 GPA index, and only few having below 2 GPA. Nine percent are freshmen, thirty seven percent are sophomore students, twenty one percent and thirty three percent are in their third and fourth year of their studies. Management, Engineering, and Accounting are the majority of fields of study of the respondents.

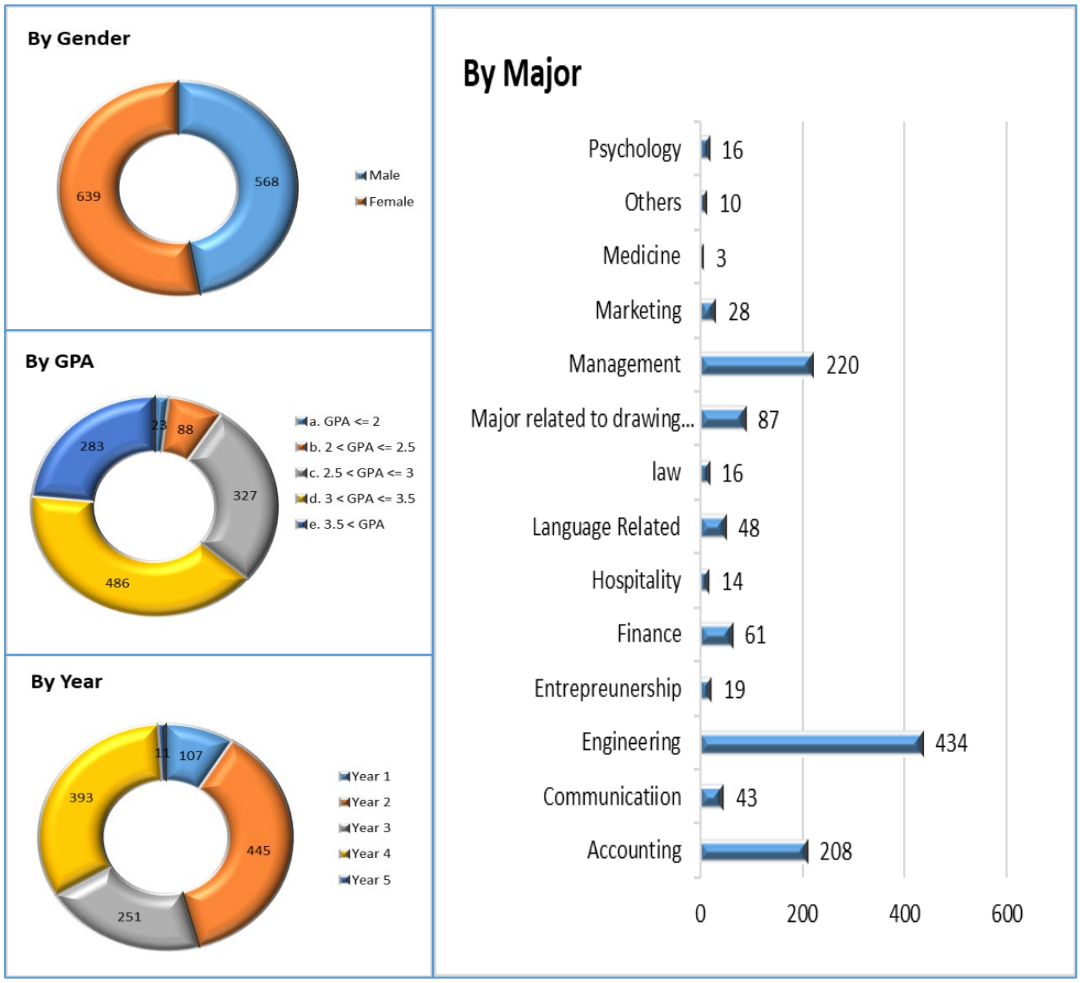

Figure 1. Respondent Profiles

4.2. Result of 2-stage Cluster Analysis

Prior to performing two-stage cluster analysis, the score for each question was converted from [-5 ; 5] into [0 : 10], so that we can take the average score on the results. As the first stage of clustering analysis, we run the data using Agglomerative Hierarchical Clustering – Ward method. A dendrogram was generated as displayed in Figure 3. AHC suggests three clusters, as indicated by the vertical dotted line in the dendrogram.

Using the number of clusters as three, K-Means Cluster Analysis was then performed. The result per each cluster in relation to eight culture dimensions is tabulated in Figure 2, while characteristics of each cluster based on respondent profiles are tabulated in Table 3. In both tables, 3-color coding is applied across the cluster, with green indicating the highest score, red the lowest score and yellow for midpoint. The color coding creates better visualization and assists in highlighting the differences.

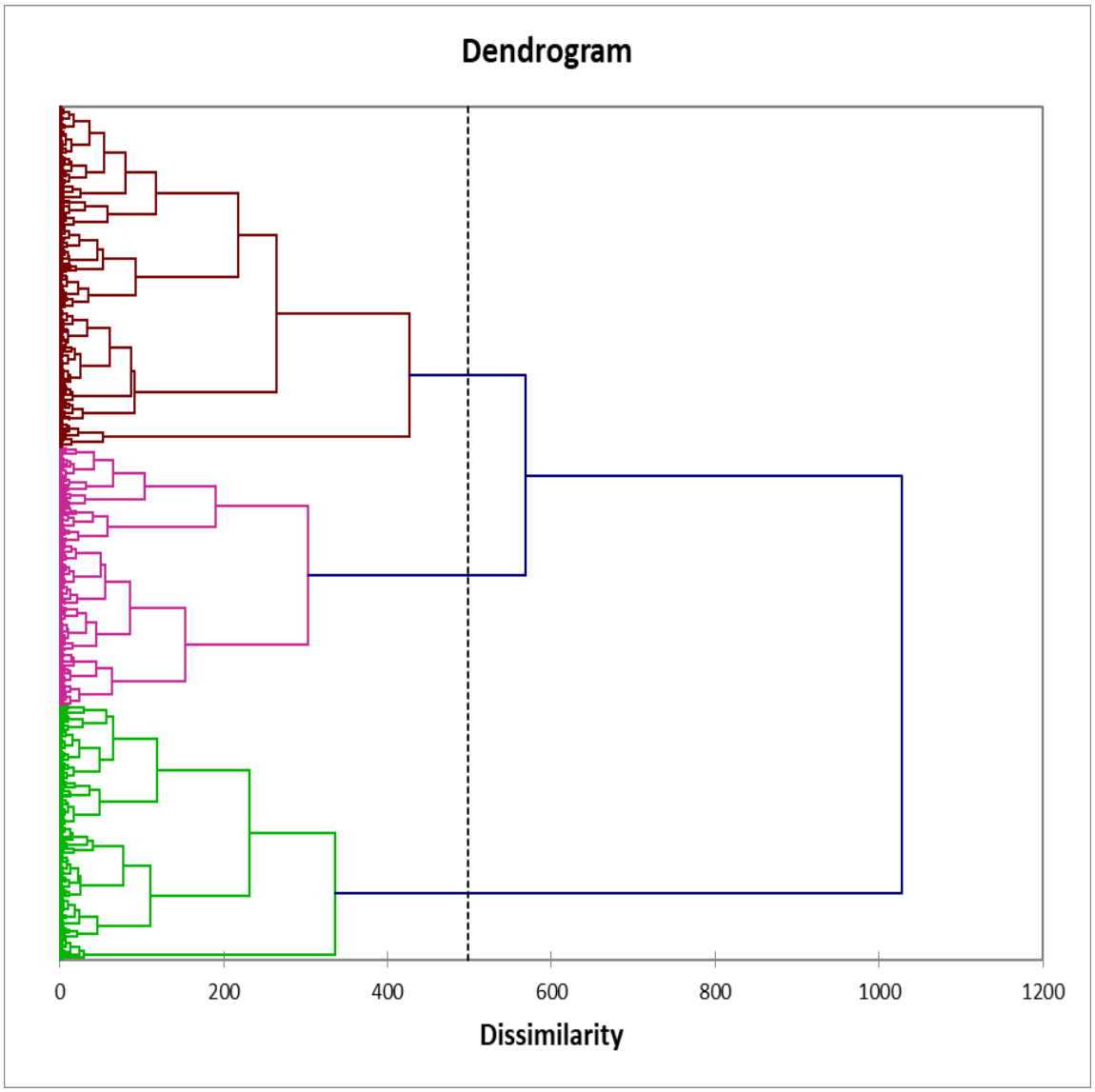

Figure 2. dendrogram – Determining Number of Cluster

Table 2: Eight Culture Dimension by Cluster

Average Score	Cluster 1	2	3	Total
Communication (Low Context – High Context)	6,36	6,85	4,53	5,82
Structure (Individualism – Collectivism)	4,66	8,08	4,81	5,77
Power (Hierarchy – Equality)	5,26	5,33	4,22	4,89
Time Orientation (Past – Future)	4,46	4,95	4,04	4,45
Competition (Competitive – Co-operative)	6,19	7,70	4,87	6,16
Action (Doing – Being)	7,75	7,12	4,57	6,36
Space (Public – Private)	5,46	5,67	4,68	5,23

Time Focus (Monochronic – Polychronic)	5,57	5,23	3,43	4,67

Table 3. Cluster by Respondent Profiles

	Cluster 1	2	3	Total
BY FIELD OF STUDY				
Accounting	70	67	71	208
Communication	14	10	19	43
Engineering	152	133	149	434
Entrepreneurship	3	9	7	19
Finance	13	15	33	61
Hospitality	4	3	7	14
Language Related	18	16	14	48
law	4	1	11	16
Major related to drawing creativity	25	25	37	87
Management	66	78	76	220
Marketing	7	6	15	28
Medicine		1	2	3
Others	3	3	4	10
Psychology	6	3	7	16
By GENDER				
Male	164	202	202	568
Female	221	168	250	639
By GPA				
GPA <= 2	8	9	6	23
2 < GPA <= 2.5	27	33	28	88
2.5 < GPA <= 3	88	122	117	327
3 < GPA <= 3.5	174	142	170	486
3.5 < GPA	88	64	131	283
BY YEAR				
Year 1	39	31	37	107
Year 2	113	150	182	445
Year 3	101	58	92	251
Year 4	128	129	136	393
Year 5	4	2	5	11
Grand Total	**385**	**370**	**452**	**1207**

4.3. Discussion and Insights

From the result, we identified 3 clusters with their own characteristics. Elaboration and discussion for each cluster are as following:

- ***Cluster 1 – The Millennial Engineers***

  This cluster is characterized by "being", "polychronic", "individualistic", and slightly "cooperative" students. If we take a look at their profile, most of them have GPA between 3 and 3.5; dominated by engineering students and 1st year students who most likely behave this way.

  "Polychronic", "being" and slightly "cooperative", indicating millennial engineering students most of which study computer/technology-related engineering domains, instead of classical engineering studies. In computer-related engineering requires coordination across different areas, which makes "cooperative" a valid requirement. If we take a closer look, the average score of this cluster is slightly similar to cluster 2. The

major difference is in "individualistic" scores, which make this cluster different and still represent the core trait of engineers.

- ***Cluster 2 – Diffused Social-studies Students.***
  This cluster is characterized by very high "collectivism" and "co-operation", preferring "high context", "equality", and "future" orientation. The highlighted difference of this cluster compared to the other two, is in its "private" orientation. In terms of profiles, this cluster is skewed to low GPA, and mostly study in management and entrepreneurship (although the number is too few to be conclusive). The slightly higher score in "future" orientation, fits the profile of management students, which require them to look at a more long-term perspective. "Private" orientation means this cluster has a diffuse culture, which together with "high-context" orientation, creates a challenge in capturing the aspiration of this cluster. To motivate this cluster will requires more engaging teaching and learning techniques.

- ***Cluster 3 – Silent Achievers***
  This cluster has the lowest score almost in all eight cultural dimensions. It has strong preference in "competition", "past", "hierarchy", "low context", "doing", "public", and "monochronic". Interestingly, most of them are actually very high achieving students with GPA more than 3.5. The GPA Profiles of this cluster is skewed to high GPA. Their fields of study are mixed, except in language -related fields. Most of them are in sophomore and last year of study. Here we can see the influence of time of study influences the way they behave. Sophomore and last year of studies are where most of the students concentrate to get a high GPA. Their differentiated trait is in being a "monochronic" (lowest average score of only 3,43), which makes them focus. This cluster represents an old-school definition of hard-working students, which fortunately the majority of the sample.

Table 4. Proposed Learning Tools

Cluster	Special Traits	Suitable Learning Goals
Generic	Public Hierarchy Past Orientation	● Lecturers' roles mix as expert and facilitator. ● A rather diffuse culture. Learning process can facilitate group work and collaboration. ● Still dwell in the past orientation. Learning experience must encourage more future orientation (e.g. ideas for improvement)
Cluster 1 – The Millennial Engineers	Individualistic, Being, Polychronic	● Combine individual and group work in the learning process. ● Encourage accomplished individuals to serve as leader or agent for change/inspiration. ● Encourage collaboration and polychronic behavior to get better results and ability to see bigger picture and more creativity.
Cluster 2 – The Diffused Social studied students	Collectivism, Cooperation, High-Context, Private	● Maintain "collectivism" and "cooperation" behavior with groupworks and collaboration in the class. ● Exploit more "future orientation" in the learning process to sharpen their analytical mind. ● Engage more class initiatives to capture high context – private aspiration.
Cluster 3 – The Silent Achievers	Monochronic Competition Low Context	● Mix this group with Cluster 2, to get a balance during the learning process. ● Acknowledge the existence of this group as leader or agent for change, with a mission to have a more collaborative teamwork. ● Challenge the "competition" behavior to include more creativity.

Across the board, most students are monochronic, as the highest average score is only 5,57. They also mostly have "public" orientation (highest average score 5,67), due to being millennials. They also prefer "hierarchy" (highest average score 5,26), and "Past" (highest average score is 4,95) orientation, driven by Indonesian culture. Nevertheless, each cluster does have its own trait which requires a different approach in the learning process. Table 4 summarizes the proposed learning goals for each cluster in order to improve students to gain better learning experience.

For cluster 1 we suggested to mix individual and group work as tools in the learning process. Group work can enhance more creativity and better result from group thinking and discussion as most of them have polychronic traits. Nevertheless, the learning style must still acknowledge the individual performance. This can be done by assigning several accomplished students as group leaders or agents for change for their peers as a source of inspiration for excellence.

For cluster 2, learning plan and strategy should stress more on groupworks and collaboration in the class, to cater to their collectivism traits and desire for cooperation. The collaboration can be done either within groups or within classes, in such a way students get engage and take more initiative so we can see their implicit aspiration. The collaboration mechanism should also involve more "future orientation" elements to assist them sharpen their analytical mind.

Cluster 3 is actually the easiest to be managed. They are independent, mature, explicit, and aware of the importance of the learning and studying process for themselves. Lecturers can make use of this cluster as the change agents to help stimulate their peers (especially those in cluster 2) during the learning process, while assisting them to gain experience and expertise as group leaders and/or moderators. Lecturers may need to explicitly acknowledge their role as group leaders to ensure they are respected by their peers so collaboration can take place. By involving them as group leaders, this cluster can soften their competition behavior in lieu of leading expertise.

Although we should apply different teaching styles to suit the preferred style of each cluster, learning behavior can be dynamic over time. It is therefore still beneficial for students to be introduced and profited from different learning strategies that may require them to develop openness to alternative learning styles. By experiencing different learning styles over time, students learn to be adaptable to a variety of environments after completing their degree, which help them to be more mature and ready for professional work.

5. Conclusion

Despite being the millennial generation, students have different cultures and preferences in the learning environment. The eight dimensions of the model of culture is a suitable tool to capture these differences. Three clusters of students identified in the study which gain insights into requirement and possibility for further improvement. As also mentioned by other previous scholars, the cultural assessment is not a static one, and can evolve over time. With that spirit, learning approaches and tools can be exercised in accordance with students' preferred style in order to form a better learning experience for the students.

In general millennial students in the greater Jakarta area still require a teacher role as experts, despite more acceptance for a less hierarchical structure and diffuse environment. They are less future oriented, which need to be improved in order to prepare them for the business environment. The 1st cluster shows a good sign where engineering students show a more polychronic behavior which can help boost creativity and better result. The 2nd cluster, where most of the social science students are, need to improve in "future" orientation in their learning process. The 3rd cluster, which is most of the students, shows a promising trend in terms of awareness for achievement. The next task is to encourage creativity in the learning process to make it better.

The study proposed a preferred learning strategy for each cluster as guidance. With the preferred and more suitable learning strategy, both lecturers and students can get an effective teaching-learning experience. Nevertheless, openness and exposure to different styles could also later be exercised to give them diverse and open learning experience.

The study has limitations in form of sampling, as it only uses convenience and snowball sampling. A wider sampling coverage and/or a longitudinal study can enhance as future opportunity to capture a better dynamic of student requirement

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