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Abstract

Examining how people learn in various learning environments is at the core of the science of learning. The more we understand how students learn from different dimensions and aspects, the better equipped we are to support their learning. This study aims to expand our understanding of how learning occurs within the context of an asynchronous online discussion. Several studies have investigated and reported on how to effectively structure and facilitate an asynchronous online discussion to promote high-quality discourse from an interventionist perspective. From the situative, participatory perspective on knowing and learning, this study aims at examining the quality of participation in an asynchronous online discussion. This includes the examination of students' participation patterns in asynchronous online discussions and the analyses of how these patterns explain their learning satisfaction and achievement. The present study identified the following participation patterns: Efficientist, Facilitator, Synthesizer, and Slacker found that there was a strong relationship of the participation patterns with learning satisfaction and learning achievement. The results indicate that participation patterns could be an important factor influencing student learning experience in an asynchronous online discussion. Future directions for research are discussed, including the analysis of social dynamics that could have an impact on participation patterns.

Background

Online threaded discussions play a vital role in asynchronous online learning. There is a wealth of research examining various aspects of asynchronous online discussions. Yet, much of such research attempted to address "what's effective" from the interventionist perspective (Woodward, 2003), such as investigating effective strategies to help students engage in online discussions (see e.g., Chen et al., 2018; Czerkawski & Lyman, 2016; Darabi et al., 2013; Lowenthal & Dunlap, 2018; Martin & Bolliger, 2018; Yilmaz & Yilmaz, 2019). In this, most of the literature on asynchronous discussion focus on providing prescriptions of how instructors should structure and facilitate an asynchronous discussion to produce a successful learning outcome.

If we are to provide an optimal learning experience, it is essential to examine learning phenomena in a particular

environment and/or context from a variety of perspectives and/or lenses. In response to this, a great deal of research has been conducted to examine the student learning experience of online discussions, such as how students interact with the environment and/or other students, what makes them engage in, how they feel, and the like (see e.g., Cheng, Long, & Koehler, 2022; Cho & Tobias, 2016; Choi, 2016; Huang et al., 2019; Martin & Bolliger, 2018). What all these studies boil down to is an examination of the learning phenomena from a person-centered approach as opposed to a system-centered approach. The present study is much in line with these efforts, which attempt to examine how learners learn in this learning environment. That said, unlike most studies that attempt to address "what's effective," the present study holds the different unit of analysis, with the intention of expanding our understanding of how learners learn in online discussions. Moving away from the interventionist approach that examines the effectiveness of various strategies implemented as well as the learning phenomena observed in online discussions, this study attempts to investigate how learners conduct their learning within the context of an asynchronous online discussion from the perspective of situated cognition and sociocultural theory. As such, the unit of analysis of this study is the quality of student participation in online discussions. This includes an examination of students' participation patterns in asynchronous online discussions and an analysis of how these patterns explain their learning experience. Such analyses are particularly worthwhile as the essence of learning in this environment can be understood as the quality of participation (Choi, 2022; Croxton, 2014; Hrastinski, 2009).

Participation Patterns in an Asynchronous Online Discussion

Asynchronous online discussions have become a vital, essential pedagogical component of online teaching and learning. Instructors use online discussions to support collaborative learning (Abawajy, 2012; Gao, Zhang, & Franklin, 2013) and to establish social and teaching presence in an asynchronous online learning environment (Akcaoglu, & Lee, 2016; Choi, 2019; Joksimović et al., 2015). Numerous studies have been conducted to investigate various strategies on how to effectively design and implement online discussions for meaningful discourse (Darabi et al., 2011; DiPasquale & Hunter, 2017; Dixson, 2010; de Lima et al., 2019). Galikyan and Admiraal (2019) found that the online asynchronous discussion board can serve as an effective instrument to reflect individual learners' level of cognitive engagement in the learning process. Darabi, Liang, Suryavanshi, and Yurekli (2013) found in their meta-analysis on the effectiveness of online discussion strategies that learners perform better if they are engaged in a purposefully structured and strategic online discussion. Yilmaz and Yilmaz (2019) investigated the effects of assigning different roles to participants in the online discussion group and found that assigning roles and responsibilities in online discussions reduced transactional distance perception and improved knowledge sharing behaviors of the students in the discussion. Parks-Stamm, Zafonte and Palenque (2017) examined the effect of the instructor's participation in an online discussion activity. They found that the instructor's engagement did not reduce student participation at any level, but the instructor's engagement was particularly needed in small classes to foster discussions. Yang, Luo, and Sun (2020) investigated the effect of group size on student engagement in online discussion. They found that small-group discussion resulted in greater participation (i.e., viewed more discussion threads, posted more content and wrote longer posts) in an online discussion than the whole class discussion.

There is also a growing body of studies reporting that student's active participation in online discussion leads to

student's academic achievement (AlJeraisy et al., 2015; Canal, Ghislandi, & Micciolo, 2015; Carceller, Dawson, & Lockyer, 2015; Galikyan & Admiraal, 2019; Song & McNary, 2011). Such studies led researchers to further examining how students participate in an asynchronous online discussion. Samuels-Peretz (2014) explored students' interaction patterns in an asynchronous online discussion. This study catalogued three interaction patterns in an asynchronous online discussion by adopting the concepts of stars (students who are referred to by others most frequently), ghosts (students whose posts are ignored by others) and isolates (students who are singled out for criticism or negative attention) that are used to analyze the group dynamics and actions in the sociometry literature (Evans, 1962) and found that students who did not contribute anything new to a discussion tended to be ignored, whereas those who offered new ideas and perspectives were promoting the quality and depth of discussions. Chan, Hew, and Cheung (2009) analyzed students behavior patterns of an asynchronous online discussion activity drawing from Hung et al (1998)'s PQRS (pointing, questioning, resolving and summarizing) framework and reported that the singular use of resolving and summarizing led to result in early thread termination, but questioning tended to increase the growth of asynchronous online discussion threads.

When examining students' participation patterns in online discussion, the majority of research focuses on the observable outcome of this learning process as to how students contribute to knowledge construction by examining the message and number of postings student made. Wise et al. (2013) claimed that "productive participation in online discussion requires more than making posts" (p. 324), and thus argued that a need exists to examine how learners engage with existing discussion posts, including when and how they attend to them, if we are to provide a detailed picture of how students learn in this learning environment. Therefore, Wise et al. (2013) introduced the concept of online "listening behaviors" and argued that listening behaviors, which are actions related to accessing the posts of others, should be considered as an aspect of participation, a productive behavior in discussion. Wise et al. (2013) proposed several dimensions for clarifying students' listening behaviors in online discussions, such as (1) depth with which students attend to comments, which can be examined by variables which measure how long students spend in discussions and on each post they actually read ; (2) the breadth with which they attend, which can be examined by variables which measure the number of different posts that students view and read; (3) temporality of their listening, which can be examined by variables which measure the frequency and length of students' sessions in which students made a post ; (4) reflectivity/revisitation, which can be examined through variables that measure the number of times students review their own posts and the posts of others that they have read previously. Wise, Hausknecht, and Zhao (2014) investigated the relationship between learners' listening behaviors and their speaking behaviors (i.e., contribute posts) in online discussions. They found that there was a connection between students' listening behaviors and the quality of posts they contributed in online asynchronous discussions. Wise and Hsiao (2019) also found that greater depth of listening to others predicted more positive positions taken in one's posts and informed breadth of listening predicted more support provided for the positions taken.

Theoretical Grounding and the Present Study

From the perspective of Vygotsky's sociocultural theory, learning is an active process of transforming participation in shared sociocultural endeavors. As learners participate actively in various social activities, they

construct the meaning and interpretation of such shared practices that are socially, culturally, and historically significant (Vygotsky, 1978). Building on sociocultural theory, Lave and Wenger (1991) further argued that learning occurs in a participation framework, not in an individual's mind. They described learning as an enculturation process where the individual uses and thinks like a practitioner in a particular context by legitimately utilizing socially-valued functions or social discourses, such as knowledge or language, resulting in a shift from novice to central participation in a community of practice (Lave & Wenger, 1991). From this perspective, knowing involves belonging, participating, communicating within the social context, and knowledge is created, reflected, and evolved through active participation. It's not a matter of processing or storing the information, but a form of competence, tool, or language bound to the social context of a community of practice (Lave & Wenger, 1991). Hence, knowledge is not a static entity in an individual's head, which can be acquired, enriched, or changed, but rather is an activity that cannot be considered separately from the context in which it arises. Therefore, learners don't accumulate knowledge from the outside, but participate in activities that are distributed among individuals, tools, and artifacts within a community (Brown et al., 1989; Lave & Wenger 1991; Rogoff, 1994; Resnick, 1987). Through this participation, individuals strengthen their ability to participate more successfully in such activities.

The sociocultural, participatory, and situated view of knowing and learning provides a solid foundation for understanding learning in an online learning environment. Hrastinski (2009) proposed a theory of online learning as online participation, stating that social and collective learner participation (i.e., taking part and maintaining relations with others) drives online learning. More importantly, participation is supported by physical and psychological tools, allowing learners and teachers to share more experiences and information, and engage in collaborative work. Choi (2022) expanded on this idea by proposing online learning as a co-labor process, which is a socially-negotiated process of attuning goals, sharing, and achieving them according to the member's agency (a capacity of social autonomous action) *in situ* over the course of learning. Choi (2022) argued that the essence of online learning and teaching is a collective effort to achieve learning goals, and it should be understood as a collective, socially-negotiated process of participation in activities, not as an individualistic, self-regulated process of acquiring knowledge.

These theoretical frameworks inform the present study, which aims to expand our understanding of learning in an asynchronous online discussion by examining participation patterns. From a situative, participatory perspective, it is crucial to analyze the quality of participation as it provides deeper insights into how learning occurs in a particular social context. The purpose of this study is twofold: 1) to identify the characteristics of participation patterns in asynchronous online discussion; and 2) to examine how these patterns relate to student learning satisfaction and achievement in asynchronous online discussion.

Methods

Context and Participants

The research context was an undergraduate course offered at a mid-sized public university in the United States of America. Four sections of the undergraduate course on Technology in Education were examined to analyze students' participation patterns in asynchronous online discussions. This course was taught using a blended (face-

to-face and online) model. Asynchronous online discussions were a central component throughout this course, and students were required to participate in weekly threaded discussions in which they posted and shared their thoughts on the course topic and interacted with their peers. The four course sections were designed and delivered using the same curriculum and taught by the same instructor. From the four sections of the course, 26 students gave their permission to have their participation patterns analyzed throughout the semester, and only these students were involved as participants in this study. All research performed, such as data collection and data analysis procedures, was approved by the author's university Institutional Review Board.

Data Sources

Student Discussion Threads

All participants' discussion postings were collected and analyzed to identify their participation patterns. Throughout the semester, participants engaged in six threaded discussion activities on different topics. Each participant's written responses were saved in a separate word file with a pseudonym to protect their confidentiality.

Log Files extracted from LMS (i.e., BlackBoard Learn)

The log files extracted from the learning management system (BlackBoard) were also collected and analyzed to capture the participants' behavior patterns in online discussions. The log files data includes following information: the average number of postings made per discussion, the average number of others' postings read per discussion, the average time spent, the average number of words per post. To protect confidentiality and match the data set, each participant's log files data was saved using the same pseudonym used in their threaded discussion data.

Self-reported Satisfaction of an Asynchronous Online Discussion Activity

At the end of the semester, participants were asked to complete a survey about their satisfaction with the online threaded discussions activity. The Asynchronous Discussion Communication Satisfaction (ADCS) scale developed by Hung and Chou (2014) was used to measure participants' satisfaction in asynchronous online discussions.

Overall Grades on Discussion Activity

The grades of each participant on their online class discussion activity were collected to examine the relationship between their participation patterns and learning achievement.

Data Analysis Procedures

Drawing from the interpretivist approach to research (Neuman, 2014), the present study aimed to understand and interpret participants' participation patterns and its relationship with learning experience, rather than to generalize and predict causes and effects.

Phase 1. Participation Patterns in Online Threaded Discussion

The study used a thematic analysis approach (Braun & Clarke, 2006) to explore the participation patterns in online discussion. This study took advantage of the theoretical and technical flexibility of thematic analysis (Braun & Clarke, 2006). First, I read each participant's written postings several times, generating an open code scheme to capture patterns and trends of their written responses across the whole discussion sessions. I then named, categorized, and described common words and phrases used in the written postings, compared them to the original written postings, and refined them as needed. This allowed for checks to ensure that a code was used consistently throughout the written postings. Codes and concepts were sorted, compared, and contrasted until saturation was reaching, meaning that no new codes or concepts were produced, to ensure their validity. With this constant revision and comparison of the written postings, these codes and concepts were subsumed under broader and more abstract themes. To improve rigor in the thematic analysis, peer debriefing was employed to obtain consensus for open codes and categories and to reduce the bias of a single researcher. A researcher with expertise in advanced qualitative research was invited to review and assess the verified interpretations, coding decisions, and the development of categories.

Phase 2. Analyzing the Characteristics of Student Behavior Patterns

Each participant's log files data was compiled and analyzed to better understand their behavior patterns, which included "thoroughness of writing," "thoroughness of listening," and "extent of the contributions." These characteristics were identified by analyzing the average number of words per post, the average number of read, and the average number of total posts made.

Phase 3. Examining the Relationships of Observed Variables

The Kruskal Wallis one-way ANOVA was conducted to examine differences in learning satisfaction and learning achievement among the different participation patterns using the dataset. The Eta Coefficient test was also performed to assess the nonlinear association between students' participation patterns and their learning satisfaction and learning achievement (i.e., final grades on online discussions). The Eta Coefficient test is a method for determining the strength of association between a categorical variable and a scale- or interval-level variable in a sample (Maxwell, Camp, & Arvey, 1981).

Findings

Participation Patterns in Asynchronous Online Discussions

The initial coding of participation patterns in participants' written postings in online threaded discussions identified 15 associated concepts, and these concepts were then collated into 8 potential themes that characterized the overall behavior patterns. These 8 potential themes were used as the basis for identifying the main themes of participation patterns in an asynchronous discussion activity (see Appendix). These emerging themes were constantly reviewed across the entire data set to refine the specific of each theme. In reviewing, refining, and

defining the themes, each participant's log file data was also used to compare and contrast. As a result of this refinement process, the eight potential themes were collapsed into the following themes (i.e., classifications): Efficientist, Synthesizer, Facilitator, and Slacker. Table 1 shows the characteristics of each of these participation patterns identified from the data analyses.

Table 1. Participation Patterns in Asynchronous Online Discussions and Characterization

Participants (N=26)	Classification	Characterization
3, 6, 8, 13, 15, 20, 21	Efficientist (Completing/Consuming)	• Less active, simply meet discussion requirements • Agreeing posts that take others' points or thoughts • Limited depth and reflectivity (avg. number of words per post = 124.82) • Limited breadth of listening (avg. number of others' postings read per discussion = 1.2) • Low engagement in session (avg. number of postings made per discussion = 3.2)
2, 4, 7, 18, 19, 23, 24	Synthesizer (Connecting/Summarizing)	• Active, exceed discussion requirements • Read other's posting thoroughly and respond to them • Reflective posts involving the summary of course content • High depth and reflectivity (avg. number of words per post =141.53) • High breadth of listening (avg. number of others' postings read per discussion =6.61) • High engagement in session (avg. number of postings made per discussion = 4.07)
1, 12, 15, 16, 17, 22, 25	Facilitator (Stimulating/Interacting)	• Highly active, exceed discussion requirements • Initiate and further develop discussions • Frequently interacting with others • Comprehensive depth and reflectivity (avg. number of words per post =130.94) • Comprehensive breadth of listening (avg. number of others' postings read per discussion = 4.42) • High engagement in session (avg. number of postings made per discussion = 4.48)
5, 9, 10, 11, 26	Slacker (Lurking/Inactive/Isolating)	• Inactive, not fully meet discussion requirements • Limited depth and reflectivity (avg. number of words per post = 103.78) • Limited breadth of listening (avg. number of others' postings read per discussion = 0.8) • Less engagement in session (avg. number of postings made per discussions = 0.8)

Relationship between Participation Patterns and Learning Satisfaction

To investigate whether students with the different participation patterns experience different levels of learning satisfaction in asynchronous online discussions, a non-parametric Kruskal-Wallis test was performed since these data were not normally distributed (Shapiro-Wilk test, $p < .05$). The results of the Kruskal-Wallis test indicated that there was a significant difference in the median scores, $\chi^2(3, N = 26) = 13.350$, $p < .05$. Follow-up test, Mann-Whitney test, was conducted to evaluate a pairwise difference among the four groups, controlling for Type 1 error across tests by using the Bonferroni adjusted alpha levels of .0083 per test (.05/6). The results of these pairwise tests indicated a significant difference between Slacker and Efficientist (p=.003), Slacker and Synthesizer (p=.007), Slacker and Facilitator (p=.002). There were no differences between Efficientist and Synthesizer, Efficientist and Facilitator, Synthesizer and Facilitator.

As seen in Figure 1, the scatterplot shows the relationship between participation patterns and learning satisfaction. To test the strength of the relationship, the measure of association (Eta coefficient) between participation patterns and learning satisfaction was computed. The Eta coefficient of η=.773 revealed a strong association between participation patterns and learning satisfaction. Specifically, the eta squared coefficient (η^2) of .558 indicated that 59.8% of the variability in the satisfaction could be explained by participation patterns. That is, its effect size is large. Essentially, there was a high association between participation patterns and learning satisfaction.

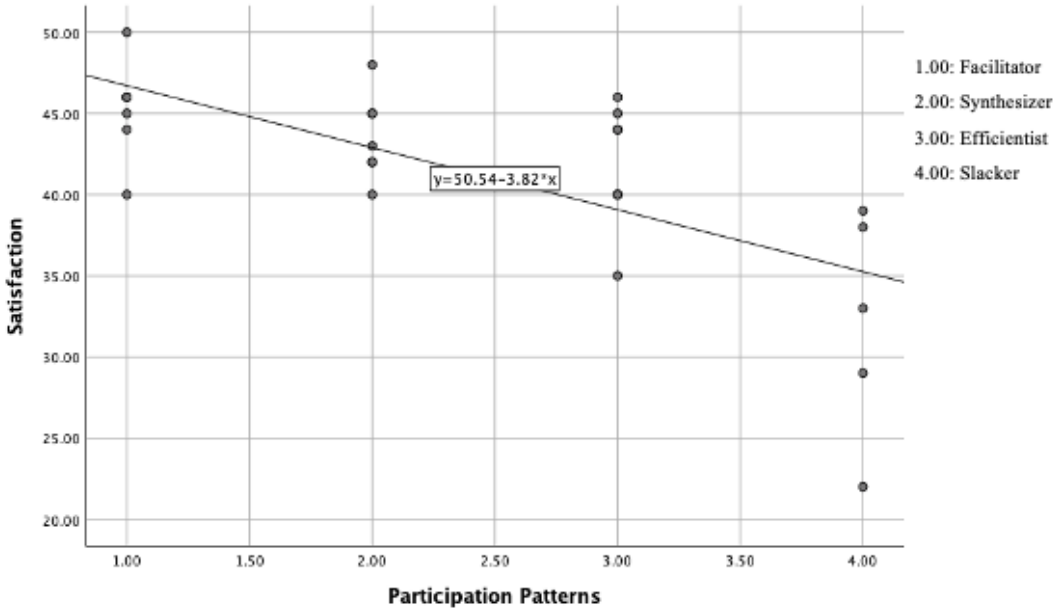

Figure 1. Association with Scatterplots between Participation Patterns and Satisfaction

Relationship between Participation Patterns and Learning Achievement

The Kruskal-Wallis test was performed to test for differences in discussion grades among different participation patterns. The results of the Kruskal-Wallis test indicated that there was a significant difference in the median scores, $\chi^2(3, N = 26) = 15.006$, $p < .05$. Follow-up test, Mann-Whitney test, was conducted to evaluate a pairwise difference among the four groups, controlling for Type 1 error across tests by using the Bonferroni adjusted alpha

levels of .0083 per test (.05/6). The results of these pairwise tests indicated a significant difference between Slacker and Efficientist (p=.003), Slacker and Synthesizer (p=.007), Slacker and Facilitator (p=.002). There were no differences between Efficientist and Synthesizer, Efficientist and Facilitator, Synthesizer and Facilitator.

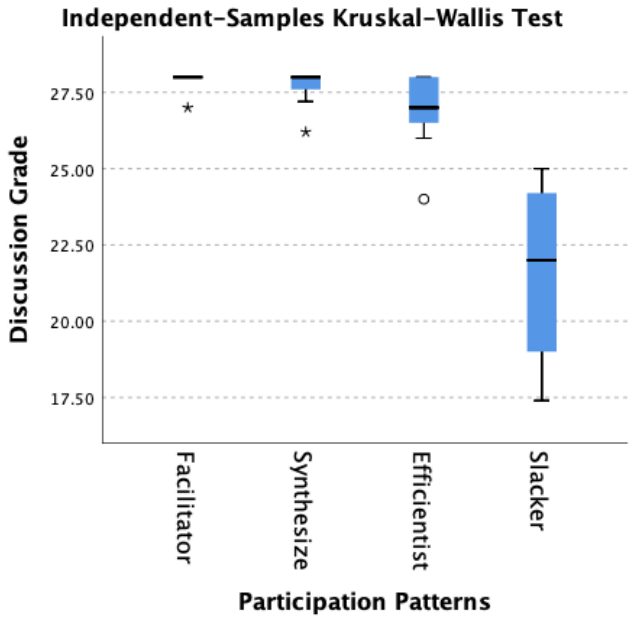

Figure 2. Comparison of Learners' Satisfaction in Discussion among Different Participation Patterns

To test the strength of the relationship, the measure of association (Eta coefficient) between participation patterns and their grades on discussion activity was computed. The Eta coefficient of η=.843 revealed a strong association between participation patterns and learning satisfaction. Specifically, the eta squared coefficient (η^2) of .771 indicated that 71.1% of the variability in the satisfaction could be explained by participation patterns. That is, its effect size is large. Essentially, there was a high association between participation patterns and learning satisfaction. Lastly, a correlation analysis was performed to examine the relationship between students learning satisfaction in online discussion activity and their grades on discussion activity. Pearson correlation coefficient (r) of .726 (p<.001) indicated that there was a strong positive relationship between learning satisfaction and learning outcome.

Discussion and Conclusion

Asynchronous online discussion is a crucial aspect of online teaching and learning that supports collaborative learning and establishes social and teaching presence in online learning environments. In response, there is a significant amount of research studying behavior patterns in asynchronous discussions with the goal of understanding individual experiences in asynchronous online discussions (Davidson-Shivers, Muilenburg, & Tanner, 2001; Jo, Park, & Lee, 2017; Knowlton, 2005; Samuels-Peretz, 2014; Wise et al., 2013). The present study expands the existing literature by identifying learners' participation patterns in asynchronous online discussions and exploring the relationship between their participation patterns and learning satisfaction and learning achievement.

First, this study categories the following participation patterns in asynchronous online discussions: "Efficientist," who tends to participate in the discussion in a most efficient way by merely fulfilling requirement and consuming other thoughts; "Facilitator," who initiates and drives discussion through frequent interactions with others' postings; "Synthesizer," who participates in discussions in a reflective, comprehensive manner by making connections to others' postings and course content; and "Slacker," who is inactive and lurks in discussions. These patterns emerged from this study share similarities with precious studies (Murphy 2004; Knowlton, 2005). Most studies on participation patterns have analyzed speaking and interaction types presented in discussion postings (i.e., how participants make a post and/or how participants make an interaction with the written postings) (Dawson, 2006; Huang et al., 2019; Jo, Park, & Lee, 2017; Kim & Bateman, 2010; Pawan, Paulus, Yalcin, & Chang, 2003), while the present study focused on capturing individual's prominent roles and dispositions by examining speaking and interaction types appeared in their written postings as well as the characteristics of behavior patterns that displayed their tendencies to take part in online discussion. This study offers a more comprehensive understanding of how students participate in an asynchronous online discussion, contributing to the discourse on participation patterns in online discussions.

Second, this study also provides evidence that students' learning satisfaction and achievement in an asynchronous discussions vary based on their participation patterns. The findings, although exploratory, suggest that participation patterns could play a significant role in student learning experience and warrant further study. Yoo and Kim (2014) found that online discussion participation patterns predicted student learning achievement (i.e., class project performance). In particular, they found that participation quantity, emotional features (i.e., positive emotion expressions), and work pattern (i.e., average posting time to deadline) that students produced through online discussions correlated with their achievement (i.e., project grades). Specifically, their study accounted for participation styles and types in their analyses, such as consistency of participation in discussion (i.e., participate in and maintain discussions throughout vs. participate only when the due date is close) and information roles (i.e., information seeking vs. information giving), and found that there was a relationship between participation styles/types and student learning achievement. The results of the present study support their findings that participation patterns could be an important factor influencing student learning experience in asynchronous online discussions. In addition, the results of pairwise comparisons among the different participation patterns that found a significant difference in learning satisfaction and achievement between Slacker and other patterns but no difference between other patterns indicate that the quality of participation is the essence of learning in an online learning environment. This result provides empirical evidence that the quality of participation, not just the quantity, drives learning in online environments (Choi, 2022; Hrastinski, 2009).

The present study has some limitations. The first limitation has to do with the width and depth of analysis since this study examined a few cases with a specific group of students. Further studies with a diverse group of participants are needed to deepen understanding. It is also important to note that student participation patterns emerged from this study may have been influenced by various contextual factors, such as interaction partners, discussion topics, and settings, which were not accounted for in the study's unit of analysis. Research examining these dynamics would provide a deeper understanding of how students learn in asynchronous online discussions. It would particularly be interesting to study individual's positionality and/or identity that has an impact on their

participation patterns. Such research could expand our understanding of engagement in online discussions.

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Appendix 1. Summary of Data Reduction of Participants' Written Postings

Themes	Initial Codes	Indicators
Efficientist	Completing	• Simply meeting the requirement • Limited effort to learn • Less interaction with others • Waiting until other classmates shared their posts
	Consuming	• Simply taking others' points or thoughts without any further additions
Facilitator	Stimulating	• Initiating/starting discussion • Asking questions • Developing further discussions
	Interacting	• Frequently interacting with others
Synthesizer	Connecting	• Building ideas based off of other's posting • Relating their own experience/knowledge to develop their post • Using course contents/materials to develop their post
	Summarizing	• Reading others' thoughts and responding them thoroughly
Slacker	Lurking/Inactive	• Limited contribution to the discussion activity
	Isolating	• Working in isolation