ANALYSIS OF THE PARTICIPATION LEVEL OF ASTRONOMY PROGRAM STUDENTS IN OIF UMSU DISSEMINATION ACTIVITIES AT MUHAMMADIYAH UNIVERSITY OF NORTH SUMATRA

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Abstract: *This study aims to analyze the level of participation of Astronomy Program students in dissemination activities conducted by the OIF (Observatory and Islamic Falak) at the University of Muhammadiyah North Sumatra (UMSU). Student participation plays a strategic role in supporting the effectiveness of dissemination programs as a medium for scientific outreach and institutional engagement. This research employs a descriptive-analytical approach with a quantitative method. Data were collected through questionnaires, observations, and documentation involving Astronomy Program students who participated in OIF UMSU dissemination activities. The level of participation was analyzed based on indicators such as attendance intensity, role involvement, contribution to activities, and responsiveness during dissemination programs. The results show that the participation level of Astronomy Program students falls within the moderate to high category, indicating a positive engagement in dissemination activities. However, several challenges were identified, including academic schedule conflicts and limited coordination mechanisms. This study concludes that strengthening institutional support and improving dissemination management strategies are essential to enhancing student participation and maximizing the impact of OIF UMSU dissemination activities.*

Keywords: *Student Participation, Dissemination Activities, Astronomy Program, OIF UMSU*

Introduction

Student participation in extracurricular and outreach activities at the university level has been widely recognized as a vital component of higher education. Active involvement in these activities allows students to extend learning beyond the classroom, strengthen their academic identity, build professional skills, and develop a sense of social responsibility. Several studies have indicated that student participation in extracurricular and outreach activities contributes not only to individual growth but also to institutional goals, such as knowledge dissemination and public engagement, which are imperative in the modern educational landscape. For instance, participation in community-based programs and co-curricular activities has been shown to enhance students' personal development, communication skills, and sense of belonging to the academic community.

In the context of science and STEM disciplines, involvement in dissemination activities plays an even more prominent role (And & Trumbul, 2002). Programs that engage students in science communication, public lectures, and informal outreach help bridge the gap between specialized academic knowledge and public understanding. Research from the U.S. shows that

when graduate students participate in science outreach programs, they report increased confidence, improved communication skills, and stronger identity as scientists and educators outcomes that reflect the broader educational value of student participation in outreach (Matthews et al., 2022).

Astronomy, as an inherently interdisciplinary field, offers unique opportunities for educational outreach and public engagement. Astronomy outreach initiatives have been shown to foster interest in STEM fields among secondary and higher education students, stimulate curiosity about scientific phenomena, and promote an inclusive scientific culture (Kerman et al., 2022). Programs that involve students in delivering astronomy outreach have demonstrated positive impacts not only on the target audience but also on the students themselves, who grow in confidence, leadership, and understanding of scientific concepts through active dissemination (Henry Wasosa, 2025).

The Observatory and Islamic Falak (OIF) at the University of Muhammadiyah North Sumatra (UMSU) is an institutional unit that facilitates astronomy-related dissemination activities, including workshops, celestial observations, public lectures, and community education. These activities are intended to enhance scientific literacy and public awareness of astronomical phenomena, aligning with the university's mission to contribute to societal knowledge . In this context, students from the Astronomy Program are expected to play an active role in planning, organizing, and implementing outreach events, thus reinforcing experiential learning and contributing to the success of dissemination initiatives.

Despite the recognized importance of student participation, empirical studies focusing specifically on astronomy program students' involvement in dissemination activities at Indonesian universities remain limited. Most existing literature on student participation has concentrated on broader educational programs like *Merdeka Belajar Kampus Merdeka (MBKM)*, showing that structured opportunities can significantly enhance student engagement and competency development (Shofia et al., 2023). Furthermore, research on general student participation in community service programs such as *Kuliah Kerja Nyata* (KKN) illustrates that when students are engaged in community-oriented activities, they can act as agents of social change and learning, acquiring competencies that go beyond traditional classroom boundaries.

Other studies in the Indonesian higher education context have explored the influence of participation on various outcomes such as academic competence, motivation, and civic awareness. For example, research on student involvement in *Kampus Mengajar* programs suggests that participation is linked to students' professional development and educational competencies, highlighting the potential benefits of structured engagement in outreach-like activities.Meanwhile, studies on student involvement in classroom-based cooperative learning reveal that active participation correlates with better academic engagement and collaboration skills.

Given the potential benefits and the lack of focused empirical evidence on astronomy outreach engagement among Indonesian university students, this study aims to analyze the **level of participation of Astronomy Program students in OIF UMSU dissemination activities**. By identifying participation indicators such as attendance, role involvement, contributions to activities, and responsiveness during dissemination programs, this research seeks to provide

insights that can inform strategies to strengthen student engagement, optimize management practices, and enhance the impact of university-level outreach initiatives.

Literature Review

Student participation in educational activities beyond the traditional classroom has been extensively studied in higher education research, particularly in relation to its effects on academic, personal, and professional development. Participation is no longer understood merely as physical attendance, but as active engagement in activities that enhance learning outcomes, build competencies, and strengthen students' sense of identity and belonging within academic communities. Extensive research demonstrates that involvement in extracurricular and out-of-class experiences provides opportunities for students to apply theoretical knowledge, develop interpersonal and leadership skills, and improve academic motivation (Stuart et al., 2011). These findings position student participation as a central component of holistic higher education.

One prominent stream of literature examines the value and outcomes of student participation in STEM outreach activities. The literature review indicates that undergraduate student involvement in STEM community service activities outside the classroom has a positive impact on academic, personal, and professional development (Simmons & Chau, 2021). Their study revealed that students who take active roles in outreach programs report moderate to strong gains in communication skills, leadership capacity, and career readiness, indicating that outreach participation plays a significant role in preparing students for future professional responsibilities. Supporting this view, a meta-analysis of informal science education programs reports a positive association between informal STEM experiences and students' interest and attitudes toward STEM disciplines. Although much of this research focuses on K–12 populations, the underlying insight remains relevant for higher education: participation in informal and extracurricular science learning environments fosters sustained interest and positive engagement, which are closely linked to persistence in STEM pathways (Xia et al., 2025).

Student participation in outreach programs is also closely related to motivational and psychosocial factors that explain both engagement levels and learning outcomes. Research on STEM outreach environments emphasizes that the quality of learning conditions such as hands-on activities, autonomy support, relevance, and opportunities for collaboration strongly influences how students perceive and benefit from participation. Outreach activities that support autonomy and intrinsic motivation tend to foster deeper engagement and more positive learning experiences, aligning with self-determination theory (Vennix et al., 2017). Beyond general STEM contexts, studies on graduate student participation in science outreach show that involvement enhances confidence, communication ability, and professional identity as scientists and educators. Qualitative findings further suggest that interacting with community audiences strengthens self-efficacy and reinforces students' sense of purpose within their discipline.

The literature also provides specific insights into astronomy and informal science engagement. Reviews of astronomy education highlight that astronomers' involvement in public outreach through observatories, planetariums, public lectures, and community observation events contributes significantly to scientific literacy, public understanding of science, and the development of science identity across diverse audiences (Pompea & Russo, 2020). These

outreach activities operate across formal and informal educational settings, demonstrating the interdisciplinary and socially embedded nature of astronomy education. Complementing this perspective, studies published in outreach-focused education journals report that university students who facilitate informal science and astronomy programs experience gains in disciplinary identity, sense of belonging, and essential career skills. This evidence underscores that outreach activities benefit not only the target audiences but also the students who serve as facilitators and communicators of scientific knowledge (Perry et al., 2025).

Research on service learning in astronomy outreach further reinforces the educational value of active participation. Studies conducted in secondary education contexts, such as service-learning astronomy programs in Malaysia, show that hands-on and community-oriented outreach initiatives lead to high levels of student participation and enhanced scientific literacy . Similarly, research on fostering STEM interest through astronomy outreach initiatives demonstrates that structured, inquiry-based experiences can enhance curiosity, conceptual understanding, and positive perceptions of STEM careers. While these studies primarily focus on younger learners, they provide transferable insights regarding the role of active participation, experiential learning, and community engagement in shaping interest and identity within STEM fields.

Beyond subject-specific contexts, broader research on extracurricular participation consistently finds that active involvement in out-of-class programs is associated with positive academic adjustment and social outcomes. Extracurricular engagement has been linked to higher academic motivation, stronger sense of belonging, and improved social adjustment, mediated through peer interaction and prosocial norms (Serra, 2019). In STEM fields, studies investigating out-of-class participation factors reveal that engagement levels are influenced not only by individual motivation but also by institutional and contextual conditions, such as program structure, scheduling, and academic recognition. These findings suggest that participation patterns are shaped by both personal and structural factors within higher education institutions.

Importantly, the literature emphasizes that student participation is a **multidimensional construct** that should be measured beyond simple attendance. Meaningful participation includes role involvement, contribution to activities, and responsiveness during programs. Studies employing descriptive statistical approaches such as frequency distributions, mean values, and measures of variability demonstrate that such methods are effective for capturing participation patterns in outreach and extracurricular settings, particularly when the research objective is exploratory or descriptive in nature. This perspective supports the use of quantitative descriptive designs to analyze participation levels within specific institutional contexts.

Collectively, this body of research establishes a strong theoretical and empirical foundation for examining student participation in outreach activities. Although much of the existing literature focuses on STEM disciplines broadly or on secondary education contexts, a consistent conclusion emerges: participation in structured experiential learning environments contributes to students' knowledge development, confidence, identity formation, and career readiness. This foundation supports the present study's focus on astronomy outreach engagement among university students and highlights a gap in empirical research addressing how astronomy program students in Indonesian higher education participate in and contribute to dissemination activities.

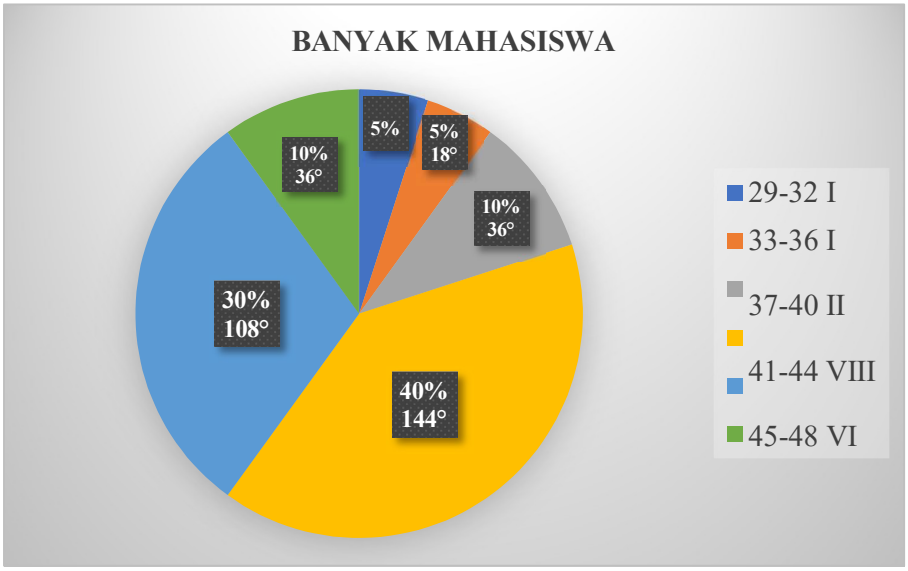
Method

This study is grounded in empirical data obtained from Astronomy (Ilmu Falak) Program students at the University of Muhammadiyah North Sumatra who have participated in dissemination activities conducted by the Observatory and Islamic Falak (OIF) UMSU. Data collection was carried out through a structured questionnaire that conceptualizes student participation as a multifaceted phenomenon, encompassing not only the frequency of attendance but also qualitative aspects of engagement, such as role involvement, contribution to activity preparation and implementation, and responsiveness during dissemination interactions. By employing a Likert scale based scoring system, students' participation experiences were translated into measurable indicators that reflect varying levels of engagement. The collected data were then examined using descriptive statistical analysis, including frequency distributions, percentages, mean values, and dispersion measures, to capture dominant participation patterns and the degree of variation among students. This approach allows participation to be interpreted not merely as numerical involvement, but as an empirical reflection of how students engage with institutional outreach practices, thereby providing a coherent basis for subsequent analysis and discussion.

Result and Discussion

The results of this study indicate that student participation in dissemination activities organized by the Observatory and Islamic Falak (OIF) UMSU is predominantly at a moderate level with a positive tendency. Based on data collected from 20 students of the Astronomy (Ilmu Falak) Program, the distribution of participation scores demonstrates a clear concentration in the middle score intervals.

Figure 1:



As illustrated in Figure 1, the largest proportion of students (40%) falls within the participation score range of 41–44, followed by 30% of students in the range of 45–48.

Collectively, these two categories account for 70% of the total respondents, indicating that the majority of students are consistently involved in dissemination activities, although not yet at an optimal level of active engagement. Similar distribution patterns have been observed in recent studies on student engagement in higher education outreach, which emphasize that moderate participation is a common outcome in voluntary academic activities (Mercer-Mapstone et al., 2017).

The central tendency of the data further supports this pattern. The mean participation score of 43.1 lies closest to the interval with the highest frequency, reinforcing the conclusion that student participation is largely clustered around a moderate level. This finding suggests that dissemination activities at OIF UMSU have been effective in attracting student attendance and maintaining regular involvement. However, the data also indicate that participation is still largely characterized by basic involvement rather than intensive engagement, such as assuming leadership roles or contributing extensively to program planning and implementation. Recent empirical studies on extracurricular engagement report similar trends, noting that without structured academic integration, students tend to participate at a functional rather than transformative level (Aldiyan Rizky, 2022).

Further insight into participation patterns can be observed from the frequency distribution presented in Table 1.

Table 1:

NO. URUT	NILAI	*fi*	*xi*
1	29-32	1	30,5
2	33-36	1	34,5
3	37-40	2	38,5
4	41-44	8	42,5
5	45-48	6	46,5
6	49-52	2	50,5
JUMLAH		**20**	**243**

The interval 41–44 represents the highest frequency, with eight students, followed by the 45–48 interval with six students. The remaining intervals contain relatively small numbers of students, indicating that extreme participation levels both very low and very high are limited. Only 10% of students fall into the highest participation category (49–52), while another 10% occupy the lowest participation categories (below 37). This relatively symmetrical distribution suggests that disengagement is not a major issue among Astronomy Program students; rather, most students demonstrate a willingness to participate but tend to remain within a comfort zone of moderate involvement. This aligns with findings from STEM outreach studies indicating that intensive engagement is often limited to a small group of highly motivated students (Bai et al., 2021).

The dispersion of participation scores across six intervals also indicates a moderate variation in student engagement (O'Shea, 2025). The absence of sharp polarization implies that participation levels are shaped by shared structural and institutional conditions rather than by stark individual differences. Contemporary higher education research emphasizes that such participation patterns commonly emerge when outreach activities are encouraged but not formally recognized within assessment frameworks or credit-bearing curricula (Kaggwa et al., 2023). In such contexts, students often balance outreach involvement with academic obligations, resulting in stable yet limited participation intensity.

When interpreted within the context of Islamic studies and ilmu falak, these findings acquire additional significance. Dissemination activities conducted by OIF UMSU such as rukyatul hilal observations, workshops, and public lectures function not only as scientific outreach but also as a form of Islamic scientific dissemination and da'wah. The moderate participation levels observed in this study may reflect the dual nature of these activities, which are recognized as valuable but may not yet be fully perceived by students as integral components of their formal academic progression. Recent research on Islamic higher education highlights that student engagement increases when religiously grounded activities are aligned with institutional learning outcomes and professional identity formation (Yusgiantara & Ibrahim, 2025).

Moreover, the multidimensional measurement of participation employed in this study covering attendance, role involvement, contribution, and responsiveness provides a more nuanced understanding of student engagement (Redmond et al., 2018). The findings indicate that while attendance rates are relatively high, deeper forms of participation, such as leadership and initiative-taking, are concentrated among a smaller group of students. This supports recent engagement frameworks that conceptualize participation as a qualitative process involving agency, ownership, and responsibility, rather than mere physical presence (Cook-sather et al., 2025).

Overall, the integration of quantitative data and visual representations demonstrates that Astronomy Program students at UMSU exhibit a positive disposition toward dissemination activities, as evidenced by the dominance of moderate-to-high participation scores and the limited presence of disengaged students. Nevertheless, the findings also highlight significant potential for improvement. Strengthening institutional strategies such as clearer role differentiation, increased lecturer mentorship, formal academic recognition, and alignment with Islamic educational objectives may encourage a shift from moderate participation toward deeper and more sustained engagement. In this way, astronomy dissemination activities can serve not only as platforms for public education but also as strategic spaces for experiential learning, scientific communication, and identity formation within Islamic higher education.

Conclusion

This study concludes that the participation of Astronomy (Ilmu Falak) Program students in dissemination activities organized by the Observatory and Islamic Falak (OIF) at the University of Muhammadiyah North Sumatra is predominantly at a moderate level with a positive tendency. The findings indicate that most students are consistently involved in dissemination activities,

particularly in terms of attendance and basic engagement, although deeper forms of participation such as leadership, initiative, and active contribution remain limited to a smaller group. This pattern suggests that while dissemination programs at OIF UMSU have been effective in attracting student involvement as part of scientific outreach and Islamic knowledge dissemination, participation has not yet reached an optimal level of transformative engagement. Therefore, strengthening institutional support through clearer role allocation, academic recognition, lecturer mentorship, and alignment with Islamic educational objectives is essential to encourage more meaningful and sustained student participation. In this way, astronomy dissemination activities can serve not only as platforms for public education and da'wah but also as strategic spaces for experiential learning and professional development within Islamic higher education.

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