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Insurance and Actuarial Olympiad in Timor-Leste: An Effort to Echance Risk Literacy in Support of Sustainable Development

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ABSTRACT

This study aimed to analyze the implementation of the Insurance and Actuarial Olympiad in Timor-Leste as a non-formal educational initiative to enhance risk literacy and support sustainable development. It employed a descriptive case study design with a non-experimental quantitative approach and secondary data analysis. The data comprised all 105 registration records from the 2025 Timor-Leste Insurance and Actuarial Olympiad. Descriptive analysis was conducted based on participants' school origins, geographical distribution, and selected competition fields. The results showed that 96 registrants (91.4%) were from Timor-Leste, while nine (8.6%) were from Indonesia. Most registrants were concentrated in Baucau, with 48 participants (45.7%), and Dili, with 27 participants (25.7%). The Insurance category was selected by 62 participants (59.0%), whereas 43 participants (41.0%) selected the Actuarial category. These findings indicate the program's geographical reach and participants' initial interest but do not demonstrate an improvement in risk literacy. The Olympiad could be developed into a continuous learning program through preparatory materials, case-based questions, feedback, and pre- and post-event evaluations using validated bilingual instruments.

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INTRODUCTION

Sustainable development takes place in the middle of increasingly complex uncertainties, such as climate change, natural disasters, health crises, and economic instability, which can cause both direct and indirect losses to society and the state (Botzen et al., 2019). To deal with these uncertainties, risk literacy, which refers to the ability to identify, assess, and communicate

risks and decide on appropriate responses, has become an important competency for the younger generation. This ability is related to numeracy skills, especially in understanding probabilities and the potential consequences of events (Cokely et al., 2012), as well as financial literacy, which helps individuals make rational economic decisions (Lusardi & Mitchell, 2014). Education can also help reduce society's vulnerability to disasters by improving their ability to adapt and prepare for possible risks (Muttarak & Lutz, 2014). In this context, insurance functions as a mechanism for transferring risk and can strengthen the resilience of individuals, families, institutions, and governments, especially in dealing with the effects of climate change and disasters in developing countries (Surminski & Oramas-Dorta, 2014).

Building risk literacy is becoming increasingly important for Timor-Leste because the country faces various risks, including floods, droughts, landslides, and tropical cyclones, as well as socio-economic pressures that may affect the achievement of sustainable development (World Bank, 2021). However, having knowledge about hazards does not necessarily mean that the younger generation is able to calculate the level of risk, understand risk management mechanisms, or choose suitable protection instruments. Researches conducted in Southeast Asian countries show that education and experience with disasters can affect community preparedness (Hoffmann & Muttarak, 2017). However, the effectiveness of risk education for children and adolescents depends greatly on the teaching methods used, the quality of evaluation, and how well the education is connected to practical actions (Johnson et al., 2014; Johnson et al., 2016). At the same time, insurance literacy is a more specific skill compared to general financial literacy because it includes an understanding of premiums, benefits, exclusions, claims, and the principles of risk sharing (Tennyson, 2011). The level of this literacy can also influence people's decisions about whether they need insurance protection (Weedige et al., 2019).

Numerous studies have found that financial education can improve people's knowledge; however, its effect on changes in behavior is not always significant and may decrease after the learning process ends (Fernandes et al., 2014). The effectiveness of financial education depends on several factors, including the intensity of the program, participants' characteristics, the timing, and how relevant the materials are to their needs (Kaiser & Menkhoff, 2017). Meanwhile, education for sustainable development focuses on a learning process that is active, interdisciplinary, participatory, and aimed at solving problems in real-life situations (Wals, 2014). Developing sustainability competencies also requires teaching approaches that include systems thinking, anticipation, collaboration, and strategic decision-making (Lozano et al., 2017). These educational approaches can improve learners' awareness, attitudes, and behaviors related to sustainability (Boeve-de Pauw et al., 2015). However, previous researches have mostly discussed financial education, disaster education, and sustainability education separately. Research on the use of Olympiads as a non-formal learning medium that combines insurance, actuarial science, risk literacy, and sustainable development, especially in the context of Timor-Leste, is still very limited. In addition, only a few studies have examined the reach of participants and the potential of Olympiads as a basis for developing measurable risk education.

To address this gap, this study analyzes the organization of the Insurance and Actuarial Olympiad in Timor-Leste as an initiative to improve risk literacy among young people and support sustainable development. A descriptive analysis was conducted using registration data from the 2025 Timor-Leste Insurance and Actuarial Olympiad, along with event documentation, to examine its geographical reach, competition categories, information

channels, and participant engagement. This study contributes in three main areas. First, from an empirical perspective, it provides an initial overview of the interest of Timor-Leste's youth in insurance and actuarial science. Second, conceptually, it connects insurance and actuarial education with risk literacy, community resilience, and education for sustainable development. Third, from a practical perspective, it provides a foundation for developing the Olympiad into an educational program that includes pre- and post-event assessments, which can support a more objective evaluation of changes in participants' knowledge, attitudes, and skills. Ultimately, the Olympiad is expected to contribute to quality education, human resource development, greater disaster resilience, climate change adaptation, and educational partnerships across borders, in line with the Sustainable Development Goals.

Risk literacy can be defined as the ability to identify sources of risk, assess their probability and possible impact, compare different ways to reduce risk, and make informed decisions. In an economic context, risk literacy is related to financial literacy because decisions about savings, investments, loans, and insurance always involve some level of uncertainty. A review of different educational interventions shows that financial literacy is not only about having knowledge, but also about being able to use that knowledge in making decisions and changing behavior (Kaiser et al., 2022). Therefore, measuring risk literacy should not only focus on the ability to define certain terms, but should also include the ability to apply concepts such as probability, consequences, diversification, and risk transfer.

Insurance literacy is one specific part of risk literacy. It includes the knowledge, skills, attitudes, and behaviors needed to understand protection needs, risk-pooling principles, premiums, benefits, exclusions, and claims. Research shows that these aspects are related to insurance inclusion, although their effects can be different across various groups in society (Kiwanuka & Sibindi, 2023). Other studies also show that people with higher insurance literacy are more likely to have insurance products that match their needs (Bongini et al., 2023). Therefore, low participation in insurance is not only related to income and access, but also to people's ability to understand the value, limitations, and functions of insurance products.

In this study, risk literacy is therefore positioned as a multidimensional competence comprising the ability to identify risks; quantitative skills for understanding probabilities and impacts; an understanding of risk mitigation, retention, and transfer strategies; and the ability to determine appropriate forms of protection. Actuarial knowledge reinforces this quantitative dimension by introducing the relationships between data, probability, loss estimation, premiums, and the sustainability of protection funds.

Research on financial education shows that educational programs can improve knowledge, although the level of impact depends on how the programs are designed and implemented. A meta-analysis of school-based financial education experiments found a significant effect on students' knowledge, while the effect on behavior was generally smaller (Kaiser & Menkhoff, 2020). These findings are also consistent with broader meta-analyses showing that financial education can influence both knowledge and behavior, with the results depending on factors such as program intensity, the relevance of the materials, participant characteristics, and the quality of evaluation (Kaiser et al., 2022). Therefore, knowledge can be seen as an initial outcome of education, while behavioral change requires opportunities for learners to apply their knowledge in decision-making situations.

An experience-based approach allows participants to take part in decision-making simulations without facing actual financial consequences. A systematic review of game-based

learning in economics education found that gaming methods can help improve economic knowledge, although their effects on motivation are not always consistent. The effectiveness of these methods depends on factors such as the level of challenge, how valuable the materials are perceived by participants, and the instructional support provided during the activity (Platz, 2022). This shows that using gaming or competition does not automatically lead to learning. Such activities need to include clear objectives, relevant content, feedback, and opportunities for reflection.

Experimental evidence also shows the potential of game-based learning. A controlled trial involving 2,220 students from four countries found that an online game-based financial education program significantly improved participants' financial literacy (Cannistrà et al., 2024). These findings show that interactive learning can be applied in different countries, although its success can still be influenced by educational conditions and participant characteristics. Therefore, applying a similar approach in Timor-Leste requires consideration of factors such as language, numeracy levels, access to technology, and participants' previous experience with financial services. In the context of Olympiads, academic competitions have two functions that may be difficult to balance: identifying the most capable participants and providing a learning experience for all participants. Research on Physics Olympiads shows that problem-solving ability is an important factor in achieving success; however, the design of the early selection process can create barriers for highly motivated participants who do not have strong specialized skills (Tschisgale et al., 2024). Therefore, the Insurance and Actuarial Olympiad should not only serve as a way to rank participants. It should also provide preparation materials, different levels of question categories, answer explanations, and follow-up activities so that participants who do not win can still gain educational benefits from the experience.

A review of the literature suggests that Olympiads can be seen as non-formal learning environments that combine achievement motivation, problem-solving, numeracy, decision-making simulations, and social interaction. The educational potential of Olympiads can be further improved when the questions go beyond simply testing participants' memorization of terms and instead require them to analyze cases, estimate possible losses, compare risk mitigation strategies, and explain their reasons for choosing certain protection measures.

Disaster risk education plays an important role in developing community knowledge, preparedness, and capacity to deal with hazardous events. A systematic review of disaster risk reduction education shows a shift from simply providing information toward learning that is more integrated, contextual, and focused on developing competencies. However, its implementation still faces several challenges, including curriculum limitations, educator capacity, access to learning resources, and limited evaluation of its impact (Tyas et al., 2025). This suggests that disaster risk education needs to maintain continuity between curriculum content, practical application, educational institutions, and the community environment.

Inclusivity is also an important aspect of risk education. Research on disaster risk reduction education for children in Indonesia shows that learning materials and teaching methods need to be designed so they can be accessed by participants with different abilities and needs (Sheehy et al., 2024). These findings are relevant to the implementation of the Olympiad because competitions that depend too much on prior knowledge, the use of only one language, or advanced calculations may limit participation. Therefore, the design of the Insurance and Actuarial Olympiad in Timor-Leste needs to balance academic standards with inclusive learning opportunities for participants from different schools and regions.

Literature on climate change suggests that disaster risk reduction, climate change adaptation, and sustainable development should not be addressed separately. These three areas have common goals, including reducing vulnerability, protecting development outcomes, and strengthening community resilience when facing different shocks (Wen et al., 2023). Within this framework, risk education can serve as a link between knowledge of hazards, preparedness, adaptation strategies, and decisions related to risk financing.

Insurance can provide funds for recovery and reduce the economic burden after a disaster. However, insurance cannot replace prevention and mitigation measures. Studies of climate risk insurance in Pacific small island states suggest that although insurance has potential as a tool for adaptation, its implementation faces several challenges, including premium affordability, the quality of risk data, institutional capacity, and access for vulnerable groups (Jain et al., 2022). The experiences of these countries provide a useful comparison for Timor-Leste, especially in understanding the protection needs of communities that face climate risks while having limited financial resources.

The effectiveness of insurance can be improved when it is integrated with disaster risk management. This integration allows insurance companies, governments, educational institutions, and the public to share data, improve risk communication, develop preventive measures, and provide financial support for recovery (Sheehan et al., 2023). Therefore, insurance literacy developed through competitions should not focus only on increasing interest in purchasing insurance products. Instead, it should help participants understand that insurance is part of a broader risk management framework that includes risk identification, prevention, mitigation, preparedness, transfer, and recovery.

Education for sustainable development requires learners to understand the connections between economic, social, and environmental aspects. The sustainability competency framework highlights the abilities to use systems thinking and futures thinking, consider values, develop strategies, collaborate, and solve problems in an integrated way (Brundiers et al., 2021). These competencies are relevant to insurance and actuarial education because risks do not occur separately. Instead, they can arise from the interaction between hazards, social vulnerability, economic conditions, the environment, and institutional capacity.

A systematic review of education for sustainable development suggests that integrating sustainability principles requires changes in learning objectives, curriculum, teaching methods, assessment, and collaboration between institutions (Lim et al., 2022). Sustainability education cannot be achieved simply by adding the term "sustainable development" to learning materials. Learners also need opportunities to analyze real-world issues, consider long-term consequences, and develop solutions that take the interests of different groups into account.

The institutional approach suggests that sustainability education can be more effective when sustainability values are consistently included in the curriculum, organization, networks, and educational practices (Holst, 2023). In the context of the Olympiad, this principle means that the Insurance and Actuarial Olympiad should not only be treated as a separate annual event. The initiative needs to be connected with instructional materials, teacher training, learning communities, participant mentoring, university partnerships, and the development of educational networks between Timor-Leste and Indonesia.

The Olympiad can contribute to sustainable development when its subject matter emphasizes the connection between risks and the achievement of development goals. Topics

such as health insurance can be related to public well-being, agricultural insurance to food security, disaster insurance to resilient settlements, and actuarial science to the financial sustainability of social protection. This approach can make insurance and actuarial science more than just technical subjects, but also useful tools for understanding development resilience.

Based on the literature review, the relationships between the concepts in this study can be described as follows: the design of the Insurance and Actuarial Olympiad influences participant engagement and problem-solving processes; these learning processes can help improve risk and insurance literacy; improved literacy can support decision-making and preparedness; and this capacity building can contribute to community resilience and sustainable development.

Table 1. Theoretical Framework

Framework Stages	Main Construct	Meaning in Research
Input	Olympiad design	Case-based problem material, difficulty level, language, mentoring/coaching, and participant access
Learning Mechanism	Engagement and problem solving	Motivation, numeracy, decision-making simulation, discussion, competition, and feedback
Direct Outcome	Risk and insurance literacy	Ability to recognize risk, understand probability, premium, benefits, mitigation, and risk transfer
Intermediate Outcome	Decision and preparedness	Ability to choose protective actions and plan risk responses
Development Impact	Sustainable resilience	Strengthening individual and community capacity to cope with economic, social, and environmental shocks
Contextual Factor	Participant and environmental condition	Prior education, numerical ability, language, region, information access, school support, and risk experience

The framework does not assume that participation in the Olympiad automatically improves risk literacy. Learning outcomes can be affected by the quality of the program design and the characteristics of the participants. Therefore, the number of registrants, schools they come from, selected competition fields, and attendance rates only indicate the reach of the program and the initial level of interest. To demonstrate an improvement in literacy, pre- and post-activity measurements using consistent indicators are needed.

METHODS

This study uses a descriptive case study design with a non-experimental quantitative approach and secondary data analysis. The case examined is the organization of the 2025 Timor-Leste Insurance and Actuarial Olympiad, with participant registration records as the main source of data. A retrospective cross-sectional design was used because each registrant was examined based on information recorded during registration and administrative follow-up. No research interventions, control groups, or repeated measurements were applied in the study.

The analysis aims to describe the program's reach, the characteristics of the registrants, the Olympiad fields they selected, information dissemination channels, and participants' administrative readiness. The unit of analysis is the individual registration record, rather than the school or region. Since the registration forms do not contain pre- and post-activity assessments of knowledge, attitudes, or behavior, this study does not directly measure changes in risk literacy. The term "efforts to enhance risk literacy" in this article refers to the educational function and potential of the program, rather than evidence of its causal effectiveness.

The study population consists of all individuals who completed the registration form for the 2025 Timor-Leste Insurance and Actuarial Olympiad, based on the data received by the researcher. A total sampling (census) approach was used, covering all registration records that met the established criteria. From the 105 registrants, 62 selected the Insurance, while 43 selected the Actuarial. Participation was voluntary and was influenced by access to information and interest in the event. Therefore, the sample was self-selected and cannot be used to generalize the level of risk literacy among the entire youth population of Timor-Leste.

RESULTS AND DISCUSSION

A total of 96 applicants (91.4%) were from schools in Timor-Leste, while nine applicants (8.6%) were from schools in Indonesia. Among the 96 applicants from Timor-Leste, 95 could be classified into ten municipalities. The complete distribution based on location and Olympiad field is presented in Table 2.

Table 2. Distribution of Registrants by School Location and Olympiad Subject Area

School Location	Insurance	Actuarial	Total	Percentage (%)
Baucau	24	24	48	45,7
Dili	17	10	27	25,7
Indonesia	9	0	9	8,6
Cova Lima	5	1	6	5,7
Bobonaro	1	2	3	2,9
Lautém	1	2	3	2,9
Ainaro	2	0	2	1,9
Liquiçá	2	0	2	1,9
Viqueque	0	2	2	1,9
Aileu	0	1	1	1,0
Ermera	1	0	1	1,0
Timor-Leste municipalities unidentified	0	1	1	1,0
Total	62	43	105	100,0

Table 2 records 48 registrants from Baucau and 27 from Dili. The number of registrants from the other eight areas ranges from one to six. Nine registrants were from Indonesia, while the remaining registrants from Timor-Leste did not provide enough information to identify their municipality. This distribution is presented in Figure 1. Among the 105 registrants, 62 selected Insurance, while 43 selected Actuarial. The distribution of the selected fields is presented in Table 3.

Table 3. Distribution of Olympiad Subject Choices

Olympiad Field	Frequency	Percentage (%)
Insurance	62	59,0
Actuarial	43	41,0
Total	105	100,0

As presented in Table 3, the difference in the number of registrants between the Insurance and Actuarial fields is 19. At the location level, Baucau had the same number of registrants in both fields, with 24 registrants each. Meanwhile, all nine registrants from

Indonesia selected the Insurance field, as presented in Table 2.

The distribution in Table 3 represents the program's recruitment reach rather than the level of risk literacy in the population. This is because competition participants voluntarily chose to participate and may have different baseline characteristics from the student population in general (Tschisgale et al., 2024). The larger number of registrants from Baucau and Dili suggests that registration coverage is not yet evenly distributed across municipalities. This pattern can be used as a basis for expanding access, since effective risk education requires outreach that is contextual and inclusive (Tyas et al., 2025; Sheehy et al., 2024).

The higher proportion of participants who chose the Insurance field compared to Actuarial Science in Table 3 may indicate a difference in initial interest between the two areas. However, this does not mean that participants understand premiums, probability, risk transfer, and protection decisions (Kiwanuka & Sibindi, 2023; Bongini et al., 2023). Insurance literacy includes knowledge, skills, attitudes, and behaviors. Therefore, the choice of registration category should only be considered an indicator of interest and cannot be treated as a measure of literacy (Kiwanuka & Sibindi, 2023; Kaiser et al., 2022).

These findings are in line with meta-analyses of financial education, which indicate that educational interventions can improve knowledge, although their effects on behavior depend on factors such as program intensity, material relevance, participant characteristics, and evaluation design (Kaiser & Menkhoff, 2020; Kaiser et al., 2022). However, unlike those studies, the data from this Olympiad only describe its reach and participants' initial interest. Therefore, the data do not yet provide evidence of changes in participants' knowledge or behavior

Research on game-based learning suggests that interactive activities can support economics education when they include clear objectives, challenges, feedback, and instructional support (Platz, 2022). Evidence from different countries also suggests that online game-based financial education can improve participants' financial literacy (Cannistrà et al., 2024). However, academic competitions may benefit participants who already have certain skills more than others, especially when the early stages do not provide enough preparation materials and learning opportunities (Tschisgale et al., 2024). In insurance research, understanding the functions, benefits, costs, exclusions, and claims process is related to the ability to make decisions about protection and to use insurance products (Kiwanuka & Sibindi, 2023; Bongini et al., 2023). Although the current study did not measure these specific aspects, the choices of the 62 participants in the Insurance and 43 participants in the Actuarial can provide a basis for developing assessment instruments for risk-transfer knowledge and quantitative skills in future activities.

The connection between the Olympiad and sustainable development comes from the potential of insurance and actuarial subjects to connect risk identification, mitigation, adaptation, recovery financing, and community resilience (Wen et al., 2023; Sheehan et al., 2023). Literature on small island states suggests that climate risk insurance can support recovery, but its implementation is affected by factors such as affordability, the availability of risk data, institutional capacity, and access for vulnerable groups (Jain et al., 2022). Therefore, the content of the Olympiad needs to present insurance as part of risk management, rather than as a replacement for prevention and mitigation measures (Sheehan et al., 2023).

The sustainability competency framework focuses on the abilities to think in systems, anticipate the future, consider values, collaborate, and solve problems in an integrated way (Brundiers et al., 2021). Developing these competencies requires alignment between learning

objectives, content, teaching methods, assessment, and institutional collaboration (Lim et al., 2022; Holst, 2023). This Olympiad functions as a non-formal risk education activity that can connect numeracy, insurance, problem-solving, and sustainability. However, the effectiveness of these connections still needs to be tested by measuring learning outcomes.

Theoretically, this study supports the distinction between indicators of program reach and indicators of learning outcomes. Factors such as the number of registrants, school location, field of study, and information channels can be considered part of the input and initial engagement stages. Meanwhile, risk literacy, preparedness, and resilience are outcomes that require separate measurement instruments (Brundiers et al., 2021; Wen et al., 2023). Therefore, the theoretical framework of this paper can be described as a sequential pathway: the design of the Olympiad encourages engagement and problem-solving; this process has the potential to improve risk literacy; and risk literacy can support preparedness and sustainable resilience (Sheehan et al., 2023; Brundiers et al., 2021).

In practical terms, organizers can increase recruitment in municipalities with low registration numbers through school partnerships, teacher training, social media, and local community engagement, while also providing bilingual materials and questions with different levels of difficulty (Holst, 2023; Sheehy et al., 2024). The questions can include scenarios related to health insurance, agriculture, disasters, and climate change, along with answer explanations and reflection sessions, so that the competition provides benefits beyond simply ranking participants (Platz, 2022; Tschisgale et al., 2024). Future evaluations should use pre- and post-tests to measure understanding of risk identification, probability, loss estimation, mitigation, premiums, benefits, exclusions, and the selection of protection strategies (Kaiser et al., 2022; Kiwanuka & Sibindi, 2023). In addition, the administrative system should assign a consistent participant code throughout the registration, confirmation, attendance, assessment, and follow-up stages to support consistent analysis of the participation process.

CONCLUSION

The main contribution of this study is to position the Insurance and Actuarial Olympiad in Timor-Leste not only as an academic competition, but also as a foundation for non-formal risk education. Empirically, this research provides a verified dataset on participant reach, patterns of interest, and recruitment pathways that can support future program development. Conceptually, the study emphasizes that participation, choice of specialization, and school background should be considered indicators of access and initial engagement rather than evidence of increased risk literacy. This distinction helps avoid unsupported causal claims while providing a possible pathway for future change: the design of the Olympiad encourages engagement and problem-solving, the learning process develops risk competence, and this competence can then contribute to better preparedness and development resilience.

In practical terms, the Olympiad needs to develop from a one-time event into a learning cycle that includes preparation materials, case-based competitions, feedback, reflection, and follow-up activities. Efforts to expand access should focus on municipalities with low participation rates through school partnerships, teacher training, local community engagement, online media, and cross-border liaison organizations. The different interests in insurance and actuarial science also require a tiered approach to the content. It can start with basic concepts of protection and risk transfer, followed by numeracy topics such as probability, loss estimation, premiums, and the sustainability of protection funds. Case studies should be based on real risks

that are relevant to Timor-Leste, such as health issues, agriculture, disasters, and climate change. This can help participants understand insurance as part of mitigation and adaptation, rather than as a replacement for prevention.

Future research needs to evaluate the effectiveness of the program using a pre-test–post-test design and, when possible, a comparison group, with validated bilingual instruments. The measurements should include knowledge, risk numeracy, attitudes, quality of decision-making, and retention of learning several months after the activity.

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