SN Computer Science (2024) 5:461
https://doi.org/10.1007/s42979-024-02729-0

ORIGINAL RESEARCH

Student-Led Live Broadcast Tour: An Elevated Learning Journey for Tourism Students

Michael T. H. Lai[1] · Emmy Yeung[2] · Larry K. W. Ching[3] · Betty M. Li[3]

Received: 6 December 2023 / Accepted: 15 February 2024

Abstract

Drawing upon the concept of student-led live broadcasting tour (LBT), this study aims to construct and empirically test the Input-Process-Output (IPO) framework that links inputs, processes, and outputs within online tourism educational context. The sample involved students who are currently studying a tourism program in the Greater Bay Area, China. One group of students was invited as the audience with another group of students acting as tour guides to lead a live broadcasting tour. Upon completion of the tour, the audience group was invited to fill in the questionnaire survey. The data were gathered through the questionnaire survey from December 2022 to March 2023. The survey instruments were designed based on existing research and the IPO framework. The quantitative data were analysed by SPSS and SmartPLS. 5 hypotheses were developed based on the IPO framework. The results confirmed that students perceived student-led LBT positively in terms of input dimensions (intrinsic motivation and resources support), process dimension (learning climate) and output dimension (learning outcomes and satisfaction). This study gives implications to educators on how student-led LBT can be designed and implemented under the constraints of travel. The utilisation of technology offers educators the possibility to enrich the learning experience of tourism students in a more affordable and effective way.

Keywords Live broadcasting tour · IPO framework · Learning effectiveness · Tourism education

Introduction

The global education sector has been significantly impacted by the COVID-19 pandemic, leading to the suspension of physical schools, and affecting over 1.5 billion students [1]. The disruption of learning was also experienced by hospitality and tourism students. The pandemic accelerated the transformation towards digitalisation in education, with courses conducted online through a number of platforms including Zoom, Google Meet and Microsoft Teams for teaching delivery; additionally, other online portals are also incorporated in teaching for a variety of learning activities, assessment submission and evaluation, and learners' autonomous learning [2, 3]. Despite the unanimous acknowledgement of online learning as the alternative for uninterrupted learning during COVID among all key parties, a number of researchers pinpointed the challenges concerning online learning, particularly in the initial phase, comprising insufficient interactive components in class delivery, improper instructional methods used by lecturers, unideal study environment and technical issues experienced by students when logging in [4–7].

This article is part of the topical collection "Agile-blended Learning with Technology" guest edited by Billy Tak Ming Wong, William Ko Wai Tang and Jessie Ming Sin Wong.

✉ Larry K. W. Ching
lching@hkmu.edu.hk

Michael T. H. Lai
thlai@cihe.edu.hk

Emmy Yeung
e.yeung@chester.ac.uk

Betty M. Li
bmli@hkmu.edu.hk

[1] Rita Tong Liu School of Business and Hospitality Management, Saint Francis University, Hong Kong SAR, China

[2] Chester Business School, University of Chester, Chester, UK

[3] Li Ka Shing School of Professional and Continuing Education, Hong Kong Metropolitan University, Hong Kong SAR, China

Published online: 20 April 2024

Above all the aforementioned limitations, the tourism education sector underwent major hurdles in cultivating study experience for students, particularly in informal learning, as the nature of the discipline is vocational and experiential-based. Due to the travel restrictions and social distancing during COVID-19, providing internships and overseas exchange tours for students was deemed less viable [8]. Extensive research has investigated the advantages of tours/excursions and field trips for tourism students, encompassing incorporating classroom learning with real-life scenarios, encouraging a proactive approach among students towards learning, individual growth, socialisation and professional networking [9–11]. The research conducted by Coe et al. [9] prompted an inquiry into whether student-centered/student-led approach will lead to increased effectiveness in learning. Despite the recent proposal and examination on provision of virtual internship as a substitute for physical internship [12–15], there has been little research investigating the possibility of student-led live-broadcasting of virtual/online tours as an option in education. It differs from the more general applications of virtual tours in e-learning platforms which are usually not synchronous and student-led in nature or the online tour notion in the industry as the sole gateway/primary means to travelling during COVID [16–18]. The objective of our study is to provide insight for the issue through investigation on the viability of organising a virtual tour and evaluation of the efficacy of this innovative education approach.

Peer learning approach features two-way communication [19], enabling reciprocated learnings among students from their peers for both formal and inform learning contexts [20]. According to Tang et al. [21], it is evident that higher degrees of students' learning engagement outside of the classroom attributes to peer learning. In spite of the thorough investigation of peer learning in the field of health sciences [22–24], similar research in hospitality and tourism remains strikingly limited. The current study strives to champion the approach of peer learning through implementing a student-led virtual exchange tour called Student-Led Live Broadcast Tour (LBT), which refers to a real-time live tour where reciprocal exchanges are conducted between the tour guide and the participants. Live streaming, which is gaining popularity, is available on portable devices for social networking sites and the internet. In particular, its extensive application has been witnessed in tourism marketing [25]. In this study, student-led LBT is manifested with students assuming the role of tour guides and presenting the attraction site to the tourists (different groups of students) through live-streaming on an internet platform.

Given the potential of student-led LBT to provide students virtual learning opportunities without the need for physical travel, in a manner which is more efficient and economical whilst taking into account the uncertainties regarding the impact of the pandemic and its possible recurrence on future student learning, this study employed the Input-Process-Output (IPO) framework as its theoretical foundation. In general, this research project seeks to (1) establish and conduct empirical examination on the IPO framework which connects inputs, process, and outputs in online tourism education context; (2) investigate the comparative influences of three inputs (e.g., intrinsic motivation, resource support, and learning climate) on process; and (3) explore the influence of process (e.g., interaction) on outputs (learning outcomes and satisfaction). The structure of this paper is as follows. The first section provides an overview of the research background and outlines the research objectives. Following this, the second section conducts a comprehensive review of existing literature, focusing on the development of hypotheses. The third section is dedicated to detailing the research methodology and the procedure for data collection. The fourth section presents the findings of the survey and the testing of hypotheses. Finally, discussions, implications and limitations of the study are covered in the final section.

Literature Review & Research Hypotheses

The IPO Framework

The IPO theoretical framework applied in the present study aims to evaluate live broadcast based on two justifications. While there are diverse existing frameworks in evaluating the quality and effectiveness of learning, a few of them comprehensively examine the entire learning process by dividing it into different stages such as the Input-Environment-Outcome (IEO) Model [26], Bigg's 3P Model (Presage-Process–Product) [27], and the IPO framework [28]. However, the IEO Model and Bigg's 3P Model have received much attention by investigating the direct and indirect impacts of early stages on learning outcomes, rather than examining stages in a progressive manner. On the other hand, the IPO framework offers more thorough insights concerning the overall learning experience as it analyses different elements in a more careful and meticulous manner. The IPO model consists of three elements, including the initial input (i.e., the possible impact on the general efficacy of an output), the process (i.e., procedures or strategies involved converting inputs into constructive outputs), and the final output (i.e., the outcomes of the relevant process). The early-stage input generates ripple effects on the process, which subsequently has effects on the output. From a pragmatic perspective, intricate processes can be decomposed as addressable units and their effects on the inputs, processes and outputs are examined in the IPO framework, enabling academics to reach decisions based on comprehensive analysis and data-driven insights. This offers valuable understanding on the

causes that lead to optimal overall student learning experiences and underscore aspects for refinement [28]. Secondly, existing research has provided evidence that employing the IPO framework to design and explore students' learning experiences results in a high level of applicability for the model, especially during the transition from traditional face-to-face learning to online learning or e-platforms [29–32]. In accordance with the IPO framework, the current research defines intrinsic motivation, resource support, and learning climate as inputs and investigates their effects on interaction (i.e., process) which subsequently contribute to learning outcomes and satisfaction with the student-led LBT (i.e., outputs).

Intrinsic Motivation and Interaction

Intrinsic motivation denotes the innate passion and determination of learners in pursuit of knowledge, instead of being involved in learning activities out of external incentives or demands [33]. Self-determination theory postulates that interaction can be assisted by intrinsic motivation as it encourages active involvement and role-taking in learning [34, 35]. Learners with intrinsic motivation demonstrate higher possibility in active interaction with peers and teachers. According to Ho et al. [36], this indicates the useful role of LBT as an educational aid in developing an understanding of the relationship between interaction and learners' intrinsic motivation. Additionally, learners' interaction in class can be enhanced by their motivation in learning [37]. Based on the IPO framework, it is suggested in this research that students' interaction is elevated by intrinsic motivation in the student-led LBT environment. The following hypothesis is subsequently posited by our study.

H1 The intrinsic motivation of learners' positively influence interaction in student-led LBT.

Resource Support and Interaction

Resource support means providing different aids in improving teaching and learning/classroom activities [38]. It involves the unique teaching and learning assistance provided in school for learners on information and instruments. Academics purported the positive correlation between sufficient resource support and interaction in study as students are enabled to participate in engaging tasks with the tools needed [39, 40]. It is revealed in these studies that learners' interaction is increased when provided learning resources. A conceptual model was proposed by Oprea [41] in illustration of student-technology-teacher interconnection. The model postulates that technology serves as the medium for teacher-student and student–student interaction while simultaneously offers engaging activities for active learning. According to Oprea's [41] it is evident that learning interaction is improved by incorporating technology resources as they offer a platform for student communication and exchanges. The significance of support regarding technology, facilities, and materials for teacher-student and peer interaction in class was also highlighted by Ghavifekr et al. [42]. Hence, we propose hypothesis 2 for the research project:

H2 Resource support positively influences interaction during the student-led LBT.

Learning Climate and Interaction

Learning climate encompasses the connectedness, rapport, or affinity felt reciprocally by the teacher and the students; it is also the environment where teachers strive to promote educational outcomes and multi-dimensional thinking [43]. A positive learning climate features an environment that inspires, motivates, supports, and promotes interactions [44]; learners feel at ease in sharing their thoughts and feelings in such an atmosphere. Learners' interaction and involvement in class are encouraged in this learning climate. According to prior studies [44, 45], teacher-student interactions are facilitated by the educators' approaches and strategies in fostering a positive learning climate. Interactions and engagement are inherently connected, as the latter naturally stems from the former [46]. The influence of learning climate on learners' engagement in virtual learning was explored by Cole et al. [47]. The findings of the research showed the positive correlation between student engagement and a positive learning climate, which consisted of components focusing on instructors and learners respectively. Consequently, it is held in our study that interactions originating from the student-led LBT could be positively impacted by learning climate.

H3 Learning climate positively influences interaction during the student-led LBT.

Interaction and Learning Outcomes

The definition of interaction is "the extent to which users can participate in modifying the form and content of a mediated environment in real time" [48, p. 5]. Active learning among learners is stimulated by interaction, as learners are prompted to engage in knowledge construction more actively [49]. An interaction properly organised in the learning process has the potential to champion students into active learning advocates from passive learners. The most paramount taxonomy of interaction was presented in Moore [50] seminal editorial, including learner-learner interaction, learner-instructor interaction, and learner-content interaction. Learning outcomes pertain to the targeted knowledge, skills and

abilities that learners are expected to achieve or cultivate through engaging in a learning activity [51]. These learning outcomes also measure the education mission set in fostering versatile and competent students [52].

It has been validated in the substantial portion of prior studies regarding the relationship between interaction and learning outcomes that students with greater self-perceived interaction with teachers and peers experience greater observed gains in intended learning than those with less self-perceived interaction [53–57]. Additionally, learner-teacher interaction maintained the prime indicator of students' perceived learning outcomes in virtual learning [58]. Referencing the empirical evidence from the literature review, we postulate a positive correlation between the interactions elicited by the student-led LBT and intended learning outcomes. Thus, the following hypothesis is proposed:

H4 Interactions formed in student-led LBT influence learning outcomes positively.

Interaction and Satisfaction

Satisfaction in student-led LBT suggests the gratification experienced by students in learning during student-led LBT [56]. The degree of learners' satisfaction often serves as the measure of effective learning in class. When learners' expectations of the student-led LBT are met, their satisfaction arises [59]. Satisfaction stems from a positive disconfirmation, while dissatisfaction results from a negative disconfirmation.

The positive connection between interaction and learners' satisfaction has been pinpointed by a number of studies [56, 60, 61]. In the Burnett et al. [60] study exploring the impact of interaction on students' satisfaction from three dimensions (i.e., frequency, intensity, and topicality), it was found that the primary indicator of satisfaction was the intensity of interaction, while the impact from topicality of interaction was secondary, and the frequency of interaction attributed the least influence. Consequently, this research argues that the strong interaction gained from LBT positively correlates with their degree of satisfaction towards the tour.

H5 Interactions formed in student-led LBT influence students' satisfaction with student-led LBT positively.

Commensurate with the previous discussions, the proposed model is presented in Fig. 1.

Methodology

Questionnaire Design

This study implemented an exploratory research approach in its questionnaire survey design. The initial measurement items were drawn from the relevant literature concerning the proposed key constructs. Before launching the main survey, the initial questionnaire was reviewed for validity by an advisory board consisting of three tourism and education experts. The final questionnaire, revised based on the experts' comments, contained seven sections. The first section included five items to measure students' intrinsic motivations adapted from the Tsai et al.'s [62] scale. The five-item adapted scale of intrinsic motivations involved generic items, such as raised curiosity, an opportunity to explore freely with specified details, learn new knowledge, and enjoy learning through the student-led LBT. In the second section, resource support was measured using six items obtained from previous studies [63, 64] that focused on educational support and classroom facilities. The learning climate was measured utilizing four items adapted from Simon et al. [65], while interaction was assessed with three items

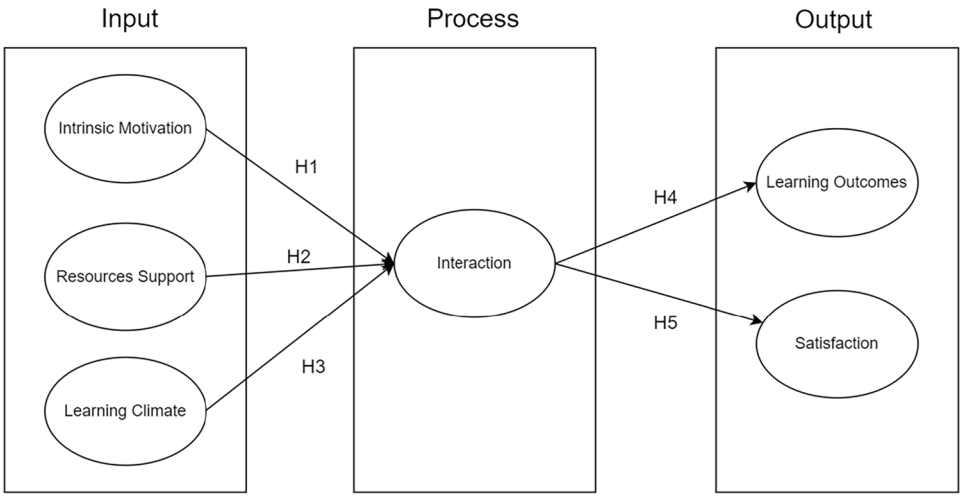

Fig. 1 The proposed model

from Gao et al. [49] and Moore [50]. In the fifth section, learning outcomes in student-led LBT were measured using five items derived from previous research [66, 67]. Additionally, the sixth section assessed satisfaction with student-led LBT using seven items based on the works of Bostwick et al. [63] and Kuo et al. [67]. All constructs were evaluated using a five-point Likert scale, where respondents indicated their level of agreement or disagreement with the statements provided. The final section collected demographic information, which included gender, current education level, year of study, major, experience in online courses, experience in virtual learning tours, and experience in-person exchange tours.

Data Collection

The data collection was conducted in December 2022 and March 2023 in the "Guangdong-Hong Kong-Macao Greater Bay Area" (GBA). The GBA is a new initiative supported by the China Central Government and was included in the strategic planning blueprint of China. The initiative covers two special administrative regions and 9 municipalities of the Guangdong province, located in the southern part of China [69] and aims to enhance the cooperation among the members of the GBA. Education is one of the important aspects of this initiative. The education institutions within the GBA are encouraged to cooperate by "*Joint offering of educational programs, student exchanges, scientific research collaboration and professional training*" [70, para.2]. To support the GBA initiative, one institution in the GBA was invited to support the current research by recruiting their students to participate in the LBT. The institution invited their students to: (1) act as a tour guide and (2) attend the student-led LBT as audience. The two groups of students were studying tourism related programs. The students participated in the student-led LBT as part of the classroom activities while their counterparts led the live tour and broadcast it via the Zoom platform. Each tour was led by 3 student guides introducing and exploring the chosen site for 25 min. After conducting prior study about the tour sites, the student guide scripted their presentation for the audience. Both a training for tour guides and a rehearsal of the tour were provided to the students for professional content delivery. The lecturer in the classroom facilitated in making sure that the broadcast was uninterrupted. A questionnaire was then distributed to all attendees of the student-led LBT surveying their learning experience. 81 participants submitted their completed questionnaires in Google Form, and they made valid data for further analysis.

Data Analysis

Raw data was entered in Statistical Package for the Social Sciences (SPSS) 29 for initial statistical processing. Normality test and descriptive analysis were used to examine the normality, profiles of respondents, and mean score of each item. Given that the data were gathered using a single research method, Harman's single factor test was used to verify the absence of common method bias (CMB). A confirmatory factor analysis (CFA) was adopted in testing the fit of measurement model. Finally, the hypotheses were tested using multiple regressions. SmartPLS 4 was used to supplement SPSS, particularly with the use of CFA.

Results and Findings

Demographic Profile of Respondents

Out of the 81 student-respondents, most respondents were female students (61.7%), while the remaining 38.3% students were male respondents. Most respondents were undergraduate students (87.8%) and most of them were in Year Three or above in degree studies (85.2%). Students with online learning experience accounted for 80% of the total respondents. However, when asked about their virtual learning tours experience, more than one-third of respondents (35.8%) reported no prior participation at all; on the other hand, around a quarter of students (25.9%) claimed to have experienced online learning tours once before, while the rest (38.3%) reported multiple engagements in similar events before. In connection to students' in-person exchange tour, just over half of the students (53.1%) indicated that they had no such experience before. Table 1 provides a detailed summary information regarding respondents' demographic features.

Validation of the Proposed Measurement Scale

An assessment of data normality and the presence of CMB was performed to ensure data quality before conducting CFA. Data normality was tested by examining the data distribution using skewness and kurtosis indicators in SPSS 29. Kline [71] suggested that a value of skewness greater than 3 may cause a problematic situation, and a value of kurtosis higher than 10 may reflect an outlier. Table 2 presents the skewness and kurtosis of variables for measuring six factors within the IPO framework. All variables obtained skewness values less than 1.0 and kurtosis coefficients lower than 2.0, which showed that the data are considered acceptable in normal distribution. To check the presence of CMB in the data, Harman's single factor test was employed to examine common method variance. The findings revealed that no single factor explained more than 50% of the variance, indicating the absence of significant CMB issues in the data.

A CFA was conducted using SmartPLS 4 to assess psychometric properties of each construct and establish the factor structure for the measurement model. Following Hair

Table 1 Demographic profile (n = 81)

	n	%
Gender		
Male	31	38.3
Female	50	61.7
Current education level		
Associate degree/Higher diploma	9	11.1
Bachelor's degree	72	88.9
Year of study		
Year 1	10	12.3
Year 2	2	2.5
Year 3 or above	69	85.2
Majors		
Tourism	57	70.4
Hospitality	24	29.6
Prior experience in online course		
Yes	66	81.5
No	15	18.5
Prior experience in virtual learning tour		
Never	29	35.8
Once	21	25.9
2–3 times	23	28.4
More than 4 times	8	9.9
Prior experience with in-person exchange tour		
Never	43	53.1
Once	13	16.0
2–3 times	20	24.7
More than 4 times	5	6.2

et al. [72], determination of factor structure is based on several criteria: (1) an item is dropped if the standardized factor loading is below 0.50; (2) three types of reliability indicators (e.g., a composite construct reliability, Cronbach's alpha, and Rho_A) achieve 0.70 or higher; (3) the heterotrait–monotrait (HTMT) ratio of correlations value is less than 0.9; (4) average variance extracted (AVE) passes the cut-off point of 0.50; and (5) AVE estimates between two factors is higher than the square of the correlation coefficient between the two factors.

As presented in Table 2, all items were significant with a factor loading value of 0.50 or above (ranging from 0.726 to 0.927). The Cronbach's alpha, composite reliability, and Rho_A reached the suggested cut-off of 0.700, indicating that the satisfactory internal consistency of multiple items of each construct. Tables 3 and 4 show the results of HTMT and AVE. The HTMT values for each item were below 0.90, which supports that discriminant validity problems did not exist. The convergent validity issue was not a problem since the AVE values were between 0.642 and 0.799, which exceeded the recommended cut-off points of 0.50. Finally, all corresponding AVE values are greater than each of the square correlation between any two constructs. Therefore, no issues related to discriminant validity were found. Based on these estimates, the final measurement model exhibited a favorable fit to the data.

Regression Results

The research utilised an array of regressions in evaluating the hypotheses postulated. The value of variable inflation factors (VIF) of all regressors were all below the limit of 10, thus multicollinearity is not found between the regressors/independent variables. The standardised coefficients of the independent variables and the results of the three regression analyses are shown in Table 5.

The first regression aimed to evaluate if the interaction of LBT is considerably influenced by the inputs in question, namely, intrinsic motivation, resources support, and learning climate. It is indicated in Table 5 that the adjusted R^2 was at noteworthy value of 0.437, signifying that the three inputs led to the 43.7% of difference in interaction. Statistical discernibility was demonstrated by resources support ($\beta = 0.400$, $p < 0.001$) and learning climate ($\beta = 0.294$, $p < 0.05$) for the impact on interaction. This implied that the resources support and learning climate were positively related to the intensity of interactions during live broadcast tour. Consequently, H2 and H3 were valid. On the contrary, the statistics indicated the insignificance of intrinsic motivation as an explanatory predictor ($\beta = 0.072$, $p > 0.05$); consequently, H1 was rejected.

The target of the second regression analysis was set to investigate if the perceived learning outcomes were impacted by the interaction elicited by the student-led LBT. The adjusted R^2 at 0.354 suggested a statistically significant result. In addition, statistical evidence showed interaction as a significant predictor for learning outcomes ($\beta = 0.602$, $p < 0.001$). This indicates the positive influence of participants' interactions in the tour on their satisfactory learning outcomes. Hence, H4 was supported.

The constructive influence of interaction on students' satisfaction towards the student-led LBT was investigated in the last regression. The result also implies the positive relationship between interaction during the tour and students' satisfaction towards the student-led LBT, with statistical evidence proving interaction as a significant predictor ($\beta = 0.622$, $p < 0.01$). H5 was accepted.

Discussion and Conclusion

Although education research acknowledges the importance of studying virtual tours, the extant literature is limited to elucidating the value of student-led live broadcast tours in hospitality and tourism education. Thus, the current study is

Table 2 Overview of the scales and items in the measurement model

	Attributes	λ	Mean	S. D	Skew	Kurt
Input						
Factor: Intrinsic motivation			3.55	0.900		
1	I am interested in the student-led LBT because I am able to learn new things	0.892	3.67	1.049	−0.689	−0.013
2	The student-led LBT raised my curiosity to study tourism	0.846	3.54	1.025	−0.333	−0.471
3	I enjoy studying in a virtual environment in which I could explore freely with specified details	0.834	3.51	1.062	−0.305	−0.694
4	The student-led LBT allowed me to continue to learn about tourism that interests me	0.874	3.60	1.008	−0.257	−0.676
5	I enjoy learning tourism knowledge through the student-led LBT other than traditional teaching methods	0.839	3.44	1.107	−0.338	−0.761
Factor: Resources support			3.47	0.824		
1	The classroom equipment and facilities were adequate to support me to participate in the student-led LBT	0.764	3.46	1.013	−0.286	−0.210
2	The school provided me with clear instructions	0.844	3.47	1.085	−0.250	−0.060
3	The school facilitated me to follow the student-led LBT	0.857	3.56	1.025	−0.439	−0.043
4	The school provided me with sufficient IT training	0.834	3.31	0.996	0.042	−0.047
5	Learning materials were well received before the student-led LBT	0.772	3.59	0.932	−0.135	−0.805
6	The internet connection was stable	0.726	3.41	1.127	−0.382	−0.532
Factor: Learning climate			3.65	0.808		
1	The tour facilitated me by providing choices and options	0.823	3.83	0.834	−0.327	−0.387
2	The tour guide made sure that I really understood the goals of the student-led LBT	0.858	3.44	1.000	0.003	−1.046
3	The tour guide encouraged me to ask questions	0.823	3.80	1.030	−0.787	0.083
4	The tour guide responded to my needs along the student-led LBT	0.860	3.48	1.001	−0.407	−0.429
Process						
Factor: Interaction			3.51	0.884		
1	The student-led LBT facilitated interactions between me and the tour guide	0.892	3.48	0.950	−0.035	−0.888
2	The student-led LBT facilitated interactions between me and other students	0.912	3.35	1.109	−0.332	−0.750
3	The student-led LBT facilitated interactions between me and teacher	0.876	3.69	0.903	−0.594	0.137
Output						
Factor: Learning Outcomes			3.69	0.758		
1	The student-led LBT allowed more engagement for me to understand the knowledge of tourism/destination	0.839	3.68	0.920	−0.596	0.028
2	The student-led LBT enhanced my learning interest in studying tourism	0.886	3.67	0.922	−0.262	−0.704
3	The student-led LBT enhanced my capability of destination/tourism knowledge	0.835	3.65	0.868	−0.315	0.091
4	The student-led LBT enhanced my learning experience in studying tourism	0.843	3.78	0.880	−0.447	−0.372
5	The student-led LBT enhanced my motivation to explore more about virtual learning	0.741	3.67	0.975	−0.692	0.507
Factor: Satisfaction			3.49	0.817		
1	I am satisfied with using the student-led LBT as a learning method	0.875	3.42	1.011	−0.408	−0.297
2	I am satisfied with the content of the student-led LBT	0.927	3.56	1.000	−0.310	−0.651
3	I feel that the student-led LBT served my needs well	0.855	3.44	1.000	−0.228	−0.453
4	Overall, I am satisfied with the student-led LBT	0.864	3.49	0.868	−0.216	−0.056

λ = Factor loading; SD = Standard deviation; Skew. = Skewness; Kurt. = Kurtosis

Table 3 Reliability and validity statistics of the measurement model

Factors	HTMT ratio (< 0.90)					
	IM	RS	LC	IN	LO	SAT
Intrinsic Motivation (IM)						
Resources Support (RS)	0.634					
Learning Climate (LC)	0.675	0.717				
Interaction (IN)	0.533	0.703				
Learning Outcomes (LO)	0.736	0.697	0.864	0.687		
Satisfaction (SAT)	0.653	0.669	0.776	0.733	0.866	
Composite reliability (> 0.70)	0.933	0.915	0907	0.923	0.917	0.933
Cronbach's alpha (> 0.70)	0.910	0.888	0.864	0.874	0.888	0.904
Rho_A (> 0.70)	0.914	0.894	0.880	0.879	0.902	0.915
Average variance extracted (> 0.50)	0.735	0.642	0.708	0.799	0.689	0.776

SRMR = 0.072; NFI = 0.788

Table 4 Correlation of the six factors in student-led LBT learning experience

Stages	Factors		RS	LC	IN	LO	SAT
Input	IM	1	0.569**	0.597**	0.475**	0.660**	0.625**
	RS		1	0.627**	0.626**	0.613**	0.581**
	LC			1	0.588**	0.663**	0.682**
Process	IN				1	0.602**	0.622**
Output	LO					1	0.702**
	SAT						1

**Correlation is significant with $p \leq 0.001$ (2-tailed)

motivated by the need for research to use the IPO framework that interconnects input, process, and output in the context of online tourism education. The findings largely conform to the hypotheses made earlier, thereby providing theoretical and managerial implications.

First, the current research argued that process is influenced by inputs, including intrinsic motivations (H1), resources support (H2) and learning climate (H3). Consistent with previous studies [41, 42], the results of this research highlight the significance of resource support in shaping interactive engagement, particularly through the utilization of technology-based resources that enhance educational interactions (H2). This trend may be attributed to the rapid advancement of STEM (Science, Technology, Engineering, and Mathematics) education in the GBA. Notably, cities like Hong Kong have been actively promoting STEM education since 2016 [73]. Similarly, Macao has launched dedicated STEM education initiatives, including investments in infrastructure and comprehensive training programs for both educators and students [74]. This may explain why institutions in the GBA are well-equipped with resources conducive to implementing LBT.

Moreover, in support of the current hypothesis and existing literature [45, 47], the results show that learning climate enhanced the formation of interactivity (H3). Therefore, this study indicates the importance of learning climate as a basis for interaction. Tour guides who developed a favorable learning climate during student-led LBT exhibited a higher level of interaction.

The investigation into the relationship between intrinsic motivations and interaction yielded an unforeseen outcome, revealing an insignificance between the two (H1). This finding was different to the previous studies and may be attributed to various underlying factors. It is possible that students' motivations are shaped by a multitude of influences beyond intrinsic drive alone [35]. External elements, such as rewards or peer pressures, play a more significant role in driving their engagement with interactions during the LBT. In addition, different students have different learning preferences and styles [75]. Some may thrive in interactive learning environments, while others may prefer independent learning. This variance in learning preferences could dilute the correlation between intrinsic motivation and interaction. Considering these dynamics, it might be beneficial to incorporate additional variables in future studies.

In line with previous findings that interaction predicts learning outcomes (H5) and satisfaction with student-led LBT (H6), this study found a significant relationship between these paths. The interactions facilitated by student-led LBT not only broadened students' perspectives and increased engagement in learning tourism but also led to higher levels of satisfaction. The interaction among

Table 5 Results of regression analyses

Variable	95% CI					
	Beta	*SE*	*LL*	*UL*	β	*p*
Regression coefficients of intrinsic motivation, resources support, learning climate on interaction						
Intrinsic motivation	0.071	0.108	−0.144	0.286	0.072	0.512
Resources support	0.429	0.122	0.187	0.672	0.400	0.001**
Learning climate	0.321	0.127	0.068	0.575	0.294	0.013*
R	0.677					
R^2	0.458					
Adjusted R^2	0.437					
F-statistic	21.672					
Std. error of the estimate	0.6632					
Regression coefficients of interaction on learning outcomes						
Interaction	0.516	0.077	0.362	0.669	0.602	0.001**
R	0.677					
R^2	0.458					
Adjusted R^2	0.437					
F-statistic	21.672					
Std. error of the estimate	0.6632					
Regression coefficients of interaction on satisfaction						
Interaction	0.575	0.081	0.413	0.738	0.622	0.001**
R	0.622					
R^2	0.387					
Adjusted R^2	0.379					
F-statistic	49.859					
Std. error of the estimate	0.644					

*$p < 0.05$; ** $p < 0.001$

audiences, tour guides and teachers facilitated a deeper understanding of travel information related to specific destinations and enhanced a greater interest in exploring virtual learning opportunities. Students found the student-led LBT to provide a well-balanced mix of information and fun, resulting in a high level of satisfaction.

Theoretical Implications

From a theoretical standpoint, student-led LBT represents a relatively novel approach to learning. This particular research area remains largely unexplored, with limited studies delving into the concept of peer learning within online tourism education. Consequently, gaining a comprehensive understanding of students' perceptions regarding student-led LBT becomes pivotal for the advancement of online learning. The present study provides new insights into the integration of student-led LBT within the context of online learning. Second, this study enriches the literature by applying the IPO framework in the context of online tourism education. In summary, it elucidates the interplay between inputs, process, and outcomes: Inputs (resource support and learning climate) foster process (interaction), which subsequently influences outputs (learning outcomes and overall satisfaction). These results not only confirm the applicability of the IPO in online tourism education and but also imply that the indirect effects of inputs on outputs are recognized through the mediator, process. An additional theoretical contribution lies in the study's examination of the relative impacts of inputs on processes and processes on outputs. Notably, resource support emerges as the strongest predictor of processes (β = 0.400). Moreover, processes exhibit a slightly stronger influence on satisfaction (β = 0.602) compared to their impact on learning outcomes (β = 0.600). These findings align with previous research, such as that of Goh et al. [76], which highlighted interaction in influencing satisfaction over learning outcomes.

Managerial Implications

As an exploratory study, the findings seemed to have provided an answer that student-led LBT can be an innovative approach to facilitate a better learning experience in acquiring the subject knowledge from the perspective of tourism students. Yet, the actual facilitation and implementation of such an approach by institutions and the challenges to be faced by tourism educators should also be pinpointed and considered in a practical aspect. Although the promotion of

STEM education and the COVID-19 pandemic mentioned earlier served as a 'catalyst' which have facilitated the trend of online learning in general, not all educators are willing and capable to adapt to such a change in their teaching approaches applied when compared with what they used to be. It is important to understand the motivation of students and to meet the audience's intrinsic motivation and engagement in learning. Institutions can augment the interaction between students and lecturers to achieve learning outcomes and enhance satisfaction. Faculty staff can consider making use of gamification to motivate students to participate and for formative assessment. Study tours or field trips become an extra burden for the family during the living crisis in many countries. Through the student-led LBT and institution resources support, the issue of widening participation and inclusion can relief. Students from less privileged family still have opportunity to learn. Given learning climate's significant positive effects on interaction, the quality and performance of student tour guides which also highly relies on the training given by educators in advance of the student-led LBT, will provide be another implication for school administers when promoting this innovative learning approach. Institutions can consider professional training complement with theoretical knowledge in teaching. During the curriculum design, the program team can consider incorporating the student-led LBT elements in teaching.

Limitations and Future Research

This study has some limitations. First, the sample size is small, which may have affected the results; in addition, the discrepancies between the number of tour guides and attendees may have also contributed to the sample size limitation. Other factors affecting sample size limitation should also be considered, including the limited intakes of tourism students at the university taking part in the project, the impediment of scheduling a period where all students are available, and the participation of students from one university only. In future research, it is recommended that the sample size be expanded and more tertiary education providers for tourism and hospitality studies be invited. The second limitation has to do with the choice of attractions as it is an important component for satisfactory student-led LBT. Each participant may have their own travel preferences. Future research is recommended to include the audience in tour-design as they could be engaged in choosing the travel sites for the tour. The third limitation concerns the data collection of the study only in the GBA, inducing constraints of exchange tour destinations within the geographical vicinity. This could result in a reduced level of differences in cultures, contributing to decreased interest and engagement for students in the tour. Future researchers should engage schools with variant cultural and geographical environments. Besides this, future studies are also advised to include insights from different stakeholders (e.g., educators and school administrators) in better conveying the advantages and problems encountered in student-let LBT in tourism education.

Acknowledgements The authors would like to thank Dr. Liam Morris for editing the paper.

Author Contributions MTHL: Conceptualization, Interpretation of Data, Writing—original draft. EY: Conceptualization, Methodology, Writing—original draft. LKWC: Conceptualization, Methodology, Writing—original draft. BML: Validation, Writing—review & editing.

Funding Not Applicable.

Data Availability The sample data set information is included in the article that supports the findings of this research.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Human or Animal Rights The questionnaire and methodology for this study was approved by the Research Ethics Committee of Hong Kong Metropolitan University.

Informed Consent Informed consent was obtained from all subjects involved in the study.

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