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Gali Naveh & Amit Shelef

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Lecture Recording Success in Academic Face- to- Face Teaching

Gali Naveh ^a and Amit Shelef ^b

^aIndustrial Engineering and Management, Shamoon College of Engineering, Beer-Sheva, Israel;

^bDepartment of Industrial Management, Sapir Academic College, Hof Ashkelon, Israel

ABSTRACT



Hundreds of academic institutions around the world dedicated considerable funding to lecture recording to accompany face-to-face teaching prior to the massive transition to distance education due to Covid-19. Furthermore, there is reason to believe that they will continue to do so after teaching will return to the physical classroom. Thus, a methodological examination of the success of lecture recordings as augmentation to face-to-face teaching should be of managerial interest. In this study, five success categories of lecture recording in a college were evaluated based on the information system success model promulgated by DeLone & McLean (1992). Results obtained through a campus-wide questionnaire and system log files showed relatively low usage of the system by students, who gave a somewhat low evaluation of system quality, information quality, and general satisfaction, but a higher assessment for the contribution of the system to their learning. Analysis also found significant correlations between success categories suggested by DeLone & McLean, with some exceptions. These results raise questions regarding the high-cost investments in lecture recording. These questions and the implication of the findings for research and higher education decision makers are discussed.

KEYWORDS

Higher education; lecture recordings; information system success; satisfaction; perceived learning

Introduction

Even prior to the swift shift to online teaching due the world wide covid-19 pandemic, providing students with access to recorded lectures was a common practice in higher education (Chapin, 2018). This practice has been perceived as a valuable service offered to students. The recordings provide increased accessibility for students who could not physically attend a lecture, and have been found to be especially helpful for students with disabilities and medical conditions (Williams, 2006), as they offer the flexibility of time and place for learning (Brandsteidl et al., 2012). Lecture recording is also used by students to revisit

CONTACT Gali Naveh  galinaveh@sce.ac.il  Industrial Engineering and Management, Shamoon College of Engineering, Beer-Sheva, Israel

points that they did not understand or would like to practice further (Bennett & Maniar, 2007; Lokuge Dona et al., 2017), to manage distractions during lectures (Gorissen et al., 2012), and to confirm the correctness of the notes they took during class (Ronchetti, 2011). Lecture recordings are specifically beneficial for students for which the teaching language is different than their mother tongue, as well as students with dyslexia (Leadbeater et al., 2013). On the other hand, lecture recording may have a negative effect on class attendance (e.g., McGrath, 2015; Owston et al., 2011) and might harm students' development as independent learners (Bennett & Maniar, 2007). Financial cost is another aspect of concern about lecture recording. Generating lecture recordings involves considerable funding, as demonstrated by Taplin et al. (2011), who estimated the cost of one hour of recording to be in the range of \$150-\$200, and indicated that in their university a few dozen hours are recorded each week. Schmidlein and Taylor (2000) suggest that decision makers at higher education institutions (HEIs) should be concerned about such ongoing financial investment and various other aspects of the service that are offered frequently to students free of direct charge. Among these concerns should be an examination of the success or failure of lecture recording programs, assuming face-to-face teaching will return to the campuses.

Students' perceptions and use of lecture recording, as well as its impact on their learning, have been the focus of past research. Most researchers present a generally positive attitude of students toward lecture recordings (e.g., Green et al., 2007; Johnston et al., 2013; Marchand et al., 2014). However, a closer look at some of these findings shows that a considerable portion of responding students have less favourable perceptions. For example, Gosper et al. (2007) found that about a third of their respondents believed that the recordings were not helpful, or they were not sure if the recordings made any change. Gosper et al. (2008) surveyed only students who chose to use the university's recording system, finding that almost a quarter (23.7%) of more than 800 respondents indicated that they had a positive experience with the recordings only about half the time they used the system.

Examining actual use of lecture recordings prior to the Covid-19 outbreak produced even less compelling results. For example, Bacro et al. (2010) examined system access logs and found that 30% of the students did not use recordings at all and 41% of the students used it very little. Similarly, Leadbeater et al. (2013) indicated that almost half the students (48%) did not use the system at all, and two thirds (67%) of those who used the system accessed it for only one or two recordings in a course. Furthermore, Taplin et al. (2011) found that although students indicated they found the recording system to be helpful, when asked to assign a monetary value to the recordings, 71% of the students responded with a zero value, indicating that they were not willing to pay anything to maintain access to the recordings. It is worth noting that some researchers present somewhat contradicting results. For example, the

research conducted by Chapin (2018), after examining two courses, found that three-quarters of the students accessed lecture recordings during the course; more than a third of those students did so on a weekly basis.

Whether watching recorded lectures affects academic performances yields further questionable benefits. Bacro et al. (2010) examined three courses and identified great variety in viewing quantity and patterns. Interestingly, they found no correlation between watching lecture recordings and final grades in a course. Leadbeater et al. (2013) found similar results when examining the correlation between lecture viewing and academic performances across and with-in cohorts studied. Johnston et al. (2013), on the other hand, found extensive use of lecture recordings offered to nursing students (an average of two accesses per student per lecture), but this group had significantly poorer academic performances when compared to the group of students that were not offered access to the lecture recordings. However, a study by Traphagan et al. (2010) revealed that viewing recorded lectures was associated with higher academic performances. These findings suggest that HEI stakeholders should consider a more thorough examination of the success of lecture recording from several aspects. Thus, this research focuses on a comprehensive approach for examining lecture recordings.

Thus, examining the success of lecture recording using multiple perspectives and data sources may contribute to the understanding of the mixed results in previous work. DeLone & McLean (1992, DeLone & McLean, 2003), proposed an interactive model for conceptualizing and operationalizing IS success, identifying numerous IS success measurements and arguing that different stakeholders of different systems may examine success differently. They based their work on a systematic analysis of decades of research examining IS success. The DeLone & McLean IS success model has been used and validated in hundreds of studies in a wide range of IS domains, including learning and teaching IS in higher education (e.g., Kim, Trimi, Park, & Rhee, 2012; Lee & Lee, 2008). Thus, the current research uses the DeLone & McLean IS success model to explore the success of lecture recordings, examining five of its six categories – system and information quality, use, user satisfaction, and net benefit.

In the context of learning technology, Freeze et al. (2010) suggest, citing others, that system quality may refer to availability, usability, a realization of user expectations, ease of learning, and response time. Information quality in a learning information system is concerned with timeliness, accuracy, relevance, and format of the information provided (Klobas & McGill, 2010). User satisfaction and use, similarly to other domains, measures the extent to which users are content with the system and use it. The former is based solely on user reports, while the latter may also be obtained through internal system logging. Such measures may include frequency of use, time of use, or the number of accesses (DeLone & McLean, 2003). Net benefit from the system in the context of learning technology is the contribution of the system to its primary goal – support of learning. Indeed,

many research projects explored the impact of the learning technology on learning itself, both as perceived by instructors and students, and by examining academic performance (e.g., Arbaugh & Benbunan-Fich, 2007; Klobas & Haddow, 2000). The next section details the methodology that was applied in this research for the purpose of assessing these measurements. The results are presented in Section 3. The paper concludes with a discussion of the results.

Methodology

This study aims to explore the success of lecture recording in face-to-face teaching in HEI. It follows DeLone and McLean's success model (DeLone & McLean, 2003) and thus examines five categories in that model. These categories are: system quality and information quality, as perceived by the students; use of the system, both as perceived by the students and via system log files; satisfaction; and benefit from the system, also as perceived by the students. The study also explores the relationship between these success measurements, based on the DeLone and McLean model (see, Figure 1). Specifically, it examines the influence of system and information quality on use and on user satisfaction, as well as the mutual influences of use, user satisfaction and net benefit.

The research was conducted at a campus of an engineering college in Israel (The college, which operates facilities in two cities, offers substantially equivalent course content at each location). The campus where the research was conducted housed approximately 3000 students. In 2010 the college was equipped with a video recording system and started recording lectures using the cloud service of a local vendor. Individual course lectures are recorded live, without editing, intervention, or other action taken by the lecturer. The system automatically uploads the recordings to the college portal. By the year 2017, the college had almost two hundred recorded courses, recording an average of 22 courses every year.

Data Collection

The appropriate human research ethics committee reviewed and approved the proposal before data was collected. Two sets of data were collected in this

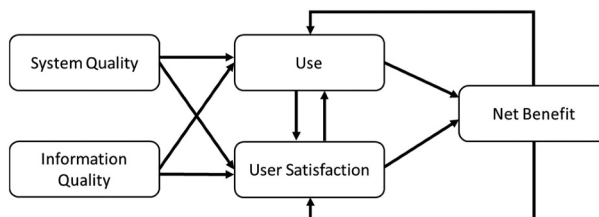


Figure 1. Research model.

research. The first was data extracted from two information systems – the lecture recording system regarding usage of the system and the college's enrolment system regarding course registration data.

The second data set was obtained via a three-part questionnaire. The questionnaire sought demographic data (including age, gender, and department), the participant's use and view of the lecture recordings, and reasons for using or not using the lecture recording system. The current study focuses on the second part of the questionnaire – students' perceptions of lecture recordings. This specific part contained 11 items, each of which asked the students to indicate their opinion using a seven-point Likert scale ranging from strongly disagree to strongly agree. An additional question focused on general use of the system, i.e., students were asked to indicate how much they used the system (ranging from never to often). The first ten items were concerned with system and information quality, general satisfaction, and net benefit. Questions focusing on system quality asked students to indicate their opinion about the quality and streaming speed of the recording, as well as the ease of use and the functionality of the system. Additional questions dealing with information quality are rather unique to the lecture recordings, because in this system, the information is the recording of an actual lecture, as it is taught. Thus, the questions were focused on the amount of lecture recordings, (i.e., the quantity of available recorded courses that students are interested in viewing) and their relevance (i.e., are they up-to-date). Net benefit of the system was concerned with the perception of the contribution of the system to student's learning, i.e., whether the students perceived that the system's support effective and efficient learning. Satisfaction with the system was obtained by a single straightforward question ("I am generally satisfied with the lecture recordings").

In order to collect data from students in all the academic departments of the college, regardless of their learning strategies and academic achievements, the data was collected using the social connections of two fourth year students both physically and online, at the end of 2017 academic year. First, the questionnaire was distributed using the instant messaging mobile application WhatsApp. The message, which included a link to a Google Forms questionnaire, was sent to student-created groups on WhatsApp, for the purpose of sharing information; the groups functioned on a year-round basis and included students in various departments and different years of study. The second distribution method was physical, at the college cafeteria, where students were randomly selected and asked to devote a few moments of their time to fill out the questionnaire. All responses gathered were included in the analysis, as described next.

Data Analysis

The video recording system logs show only that a course recording was accessed; they do not record the viewing duration or the identity of the viewer.

The report produced from the system contains the count of the number of times each recorded course was accessed during the 2017 academic year. This data was combined with information from the college's enrolment system, to produce the average views per student per course (i.e., the number of views of a course during the 2017 academic year, divided by the number of students enrolled in the course in the same academic year). Some of the previously recorded courses were replaced with new courses in which a large portion of the old recordings are still relevant, despite the mismatch between the original name of the course as recorded, and the course offered to students in 2017. Where possible, a matching was made between enrolments in the new courses to the recording of old ones. For eight courses, such matching was unsuccessful (due to changes in content between old and new courses) and thus, the data regarding them were excluded from the analysis. Another group of courses excluded from the analysis included graduate courses recorded in the 2017 academic year. In these courses, a face-to-face lecture was conducted at one campus and was recorded and transmitted synchronously to the other campus. Thus, views of these recordings do not represent typical voluntary use of lecture recordings by students.

The data gathered through the questionnaire was first analysed with descriptive statistics. Next, confirmatory factor analysis was performed to verify the components and validity of the questionnaire. The correlations between the dependent and independent variables were then explored and, where relevant, a regression analysis was conducted to examine the explanatory power of the independent variables.

Results

There were 98 respondents (46.9% females and 53.1% males, as shown in [Table 1](#)). The number who responded online was approximately the same as the number who used written hard copy responses. Most (54.1%) respondents were in their fourth (final) year of study and close to a quarter (23.5%) were third-year students.

Most of the respondents were enrolled in the Chemical Engineering department (31.6%) and the Industrial Engineering and Management department (37.8%). Close to forty percent of the respondents (46.6% females and 34.6% males) did not use the system at all, and a similar percentage used the system only a few times. Four percent of the respondents indicated that they watched lecture recordings often.

The Cronbach's alpha score was 0.866, which indicates the reliability of the questionnaire. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.75, above the commonly recommended value of at least 0.6. Factor analysis using principal components extraction method and Varimax rotation indicated three factors as shown in [Table 2](#): system quality (items 1–4), information quality

Table 1. Descriptive statistics of respondents.

		Frequency	Percent
Year of study	First	8	8.16%
	Second	14	14.29%
	Third	23	23.47%
	Fourth	53	54.08%
Department	Chemical Engineering	31	31.63%
	Civil Engineering	7	7.14%
	Electrical and Electronics Engineering	14	14.29%
	Industrial Engineering and Management	37	37.76%
	Mechanical Engineering	8	8.16%
	Software Engineering	1	1.02%
Gender	Female	46	46.94%
	Male	52	53.06%
Use of the system	Never watched the recordings	39	39.80%
	Watched few lecturer recordings	44	44.90%
	Watched large portion of some courses	11	11.22%
	Watch recordings often	4	4.08%
Total		98	100.00%

(items 6–7), and net benefit (items 5, 8–10). These results support the validity of the questionnaires' constructs. The Cronbach's alpha score was 0.84 for the four statements dealing with system quality, 0.90 for the four statements dealing with net benefit, and 0.64 for two statements dealing with information quality. These scores indicate the reliability of the questionnaire, although the last value is slightly lower than 0.7. A value of less than 0.7 is an expected event, as the two questions are concerned with two different dimensions of data quality (Fox et al., 1994). The overall evaluation of those using the system ($n = 62$) ranged between 3.1 (system quality) and 4.6 (perceived net benefit of the system).

Table 3 presents the average and standard deviation students' evaluation of the system on the three factors (system quality, information quality and net benefit), as well as their satisfaction.

Correlations between use of the system and system quality, information quality, and satisfaction were not statistically significant. All other explored relationships were found to be statistically significant, as can be seen in Table 4. The highest significant correlation found was between system quality and user satisfaction (0.738, p -value<0.001) and the lowest was between information quality and net benefit (0.359, p -value<0.01). Next, the relationships

Table 2. Rotated factor loadings.

Item		System quality	Information quality	Net benefit
Item 1	Convenient and easy to operate			0.813
Item 2	Supports effective use			0.854
Item 3	Recording quality			0.762
Item 4	Streaming speed			0.727
Item 6	Quantity of course recorded		0.872	
Item 7	Courses recorded are up-to-date		0.735	
Item 5	System helps learning	0.743		
Item 8	Learning efficiency	0.824		
Item 9	Watching helps learning	0.945		
Item 10	Convenient to learn	0.848		

Suppress absolute values <0.50.

Table 3. Descriptive statistics of students' evaluation of the system.

	Mean	Std. Deviation
System quality	4.027	1.354
Information quality	3.105	1.457
User satisfaction	3.694	1.646
Net benefit	4.601	1.529

Table 4. Correlations between model components.

	System quality	Information quality	User satisfaction	Use of the system	Net benefit
System quality	1	0.391**	0.738***	-0.041	0.466***
Information quality		1	0.557***	0.101	0.359**
User satisfaction			1	0.228	0.670***
Use of the system				1	0.368**
Net benefit					1

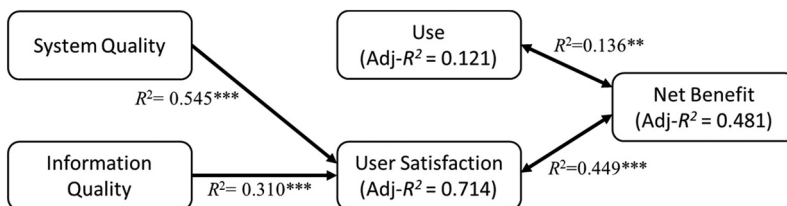
***Correlation is significant at the 0.001 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

between the components of the research conceptual model were examined using regression analysis, as shown in Figure 2.

Three regression analyses were performed in order to examine the effect of several variables on the use of the system, satisfaction, and net benefit. The results – including the coefficients, t-statistics, and significance level for each independent variable – are detailed in Table 5. First, regression analysis revealed that the influence of net benefit on the use of the system is significant (p -value = 0.003). Net benefit explains the 12.1% variance in the use of the system. Second, a regression analysis was conducted for the influence on user satisfaction by system quality, net benefit, and information quality. The model is significant (p -value<0.001) and explains the 71.4% variance in users' satisfaction variance. Third, a regression analysis was conducted to determine the influence of user satisfaction and use of the system, on the perceived net benefit. The model is significant (p -value<0.001) and explains the 48.1% variance in perceived net benefit.

As mentioned, use was also measured using log files of the lecture recording system. During the 2017 academic year, the total number of accesses to the system by students was 26,016. Out of 177 recorded courses, 78 courses (44.1%)



*** p -value<0.001, ** p -value<0.01

Figure 2. R-squares for the research model.

Table 5. Regressions for use of the system, user satisfaction, and net benefit.

Dependent variable	R^2	Adj- R^2	p -value	Independent variables and intercept	β coefficient	t -statistic	p -value
System use	0.136	0.121	0.003	Intercept (constant)	0.536*	2.166	0.034
				Net benefit	0.157**	3.070	0.003
User satisfaction	0.728	0.714	<0.001	Intercept (constant)	-1.271**	-3.055	0.003
				System quality	0.578***	5.912	<0.001
				Net benefit	0.390***	4.571	<0.001
				Information quality	0.272**	3.162	0.002
Net benefit	0.498	0.481	<0.001	Intercept (constant)	1.805***	4.485	<0.001
				User satisfaction	0.575***	6.532	<0.001
				Use of the system	0.534	2.402	0.019

***Coefficient is significant at the 0.001 level.

**Coefficient is significant at the 0.01 level.

*Coefficient is significant at the 0.05 level.

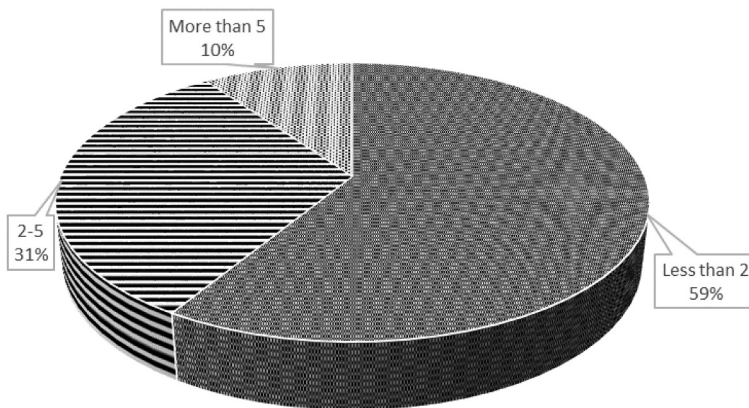


Figure 3. Frequency of courses according to number of views per course per student (for courses that were accessed at least once).

were not accessed at all. None of the courses that were recorded in the years 2010 and 2011 were accessed, and only 8% of the 2012 courses were viewed at all. The average number of accesses per course per student was 1.36, with 2.04 as an average for courses that were accessed at least once. Figure 3 presents the frequency of courses, according to the average number of accesses per course per student, for courses that were viewed at least once. More than half (59%) of these courses had an average of fewer than two accesses per student, resulting in a total of only a quarter of all courses that were accessed an average of twice or more per course per student. Only 10% of the courses that were accessed were viewed an average of 5 times or more per student.

Discussion and Conclusion

This research explored the success of lecture recording in an HEI as an accompanying resource to face-to-face teaching. Based on both subjective and objective data, multiple measurements were used in order to produce a comprehensive

evaluation, following DeLone and McLean success model (DeLone & McLean, 2003). Data analysis confirms the relevance of that model to this learning technology, as system quality and information quality were found to be correlated to user satisfaction, and use and user satisfaction were correlated to net benefit. However, use was found to be correlated only to net benefit. This finding is not in line with DeLone and McLean's model. Surprisingly, except for Gorissen et al. (2012), who found weak positive correlation between ease of use of system functionality to use of lecture recordings, no research that explored the factors affecting success of lecture recordings in the context of IS was found. Thus, further research should be conducted in order to validate this study's findings and explore other aspects that may uncover a more dominant determinant of use in the context of lecture recording.

Results show a somewhat low success of lecture recordings, in all success measurements, both captured from students' perceptions and by system logs. Approximately 40% of the students never used the system and more than 40% of the courses were not viewed at all during a full academic year. Approximately three-quarters of the courses were accessed, on average, twice or less by each student. These findings are similar to results of other researchers (e.g., Green et al., 2007; Taplin et al., 2011) and suggest that a low portion of the students use the recordings relatively extensively, while most students use them rarely, or not at all. On a seven-point Likert scale, the average general satisfaction was only 3.7. Interestingly, the highest evaluation by the students was of the contribution of the system to their learning (4.6), suggesting that students believed the recordings help them. However, they do not extensively use them and are not completely satisfied with the system or its characteristics. These moderated evaluations of the recordings are consistent with those of other researchers (e.g., Chester et al., 2011).

When examining the situation from an IS implementation perspective, the findings are not surprising when one considers that HEIs seldom conduct planned, strategy-driven implementation projects that are especially important for rigid institutions such as universities (O'Callaghan et al., 2017). This, of course, may change dramatically if and when teaching will return into physical classrooms, as the current use of lecture recordings in higher education teaching is forced by a worldwide crisis, and the uncertainty of how higher education teaching will look like in the near and far future is high.

None the less, HEI decision-makers who seek to improve the return on investment of lecture recording systems, may want to consider taking actions to promote the use of the system and buy-in of their students and lecturers if and when teaching will return to a face-to-face format. Such actions may be of a technological nature (e.g., mobile application to support easy and convenient access, generating shorter videos in a YouTube or similar format). Activities of an organizational or administrative nature such as advertisement of the service or posting links to the recording on course web sites, could also prove beneficial. Promoting the quantity and quality

of the use of lecture recording may also be supported by lecturers. Additionally, in a traditional face to face course, the teaching staff could encourage students to use the recording as a supplementary resource while outlining the best way to leverage it in order to optimize its contribution to the overall student learning experience (McGrath, 2015).

Another implication of the research findings addresses the “life span” of lecture recording. Data collected showed students rarely access recordings that are more than five years old. This finding should be validated in further research and, if confirmed, may add a consideration to the process of making decisions regarding recording in general and recording of a specific course or lecturer in particular, as well as the archiving of old recordings.

This study has several limitations. Most importantly, it explored students’ perception in a pre-pandemic world. It is expected that students’ (and instructors’) views will change profoundly after a few semesters of fully online learning and teaching, and relying heavily on online resources. However, it is expected that at least in some of the courses and programs, face-to-face teaching will become dominant again, making the results in this study relevant. Another limitation is the number of respondents and the survey distribution methodology may limit the generality of the findings, although the objective data (recording system logs) support the findings gathered through the questionnaire. Additionally, although the response rate is unclear, the distribution method suggests that response rate bias would not be excessive. Filling out the questionnaire was presented to potential subjects as a favour to their fellow students distributing it, as the request was conveyed directly by and to students with no visible indication of any objective or motive other than helping the students who asked for their time to fill out the survey. This selection process suggests that a subject’s decision to participate was not based on his or her perception of lecture recordings, but a willingness to help other students.

Another limitation of the study is that system usage documentation was limited to the number of views, with no information available regarding the viewing duration and the number of users performing these views. This study limitation restricts the ability to gain insights about the use of the system by students.

Despite its limitations, this research, similar to some other investigations focusing on lecture recordings, presents some questions regarding its use as an addition to face-to-face teaching in academia. It is a service that requires substantial financial resources with no compelling evidence that it makes a significant contribution to students’ learning and satisfaction. Further research about the determinants of lecture recording success is required if HEI decision-makers are to adequately address this issue in a post-pandemic world. Exploring technological and functional aspects (such as media format, devices supported, search, and bookmarks support), as well as pedagogical effects (like course type and teaching style, as well as methodological incorporation of the videos into teaching), may improve the ability to use lecture

recording systems to generate more significant benefit to the students in face-to-face teaching.

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ORCID

Gali Naveh  <http://orcid.org/0000-0002-7002-2606>

Amit Shelef  <http://orcid.org/0000-0003-3133-2713>

Availability of Data and Material

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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