The Implementation of Social Network Analysis on the Usage Patterns of Student Digital Locker Services: Case of Indonesian Private University

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Abstract

Background: *The social network analysis approach in the field of education is relatively new, especially in the context of the adoption of academic information systems by students. The purpose of this research is to find out the popularity of academic information services accessed by students in their digital lockers at Universitas Gunadarma.*

Materials and Methods: *The research method used is Social Network Analysis (SNA). The software applications used are Ucinet for data processing and NetDraw for visualization of usage patterns for digital locker service features.*

Results: *The three most frequently accessed service features are course schedules, assignments, and digital student portfolios. SNA can identify grouping system service features that include two groups, namely administrative services and academic information services that support the learning process. Network analysis also showed differences in the frequency of use of other service features based on gender point of view.*

Conclusion: *The results of this study can be used as input or consideration for information system managers in universities to analyze the behavior of students in the use of information systems in accordance with their respective interests.*

Key Word: *online education, digital locker, social network analysis, Ucinet, NetDraw*

I. Introduction

The implementation of Information and Communication Technology (ICT) in the university is a necessity in accordance with the demands of the community. The use of information technology can help and encourage universities to address the challenges of the information society with the ever-changing demands of education and knowledge.[1] Dramatic reforms of higher education are needed and made possible in order to provide better information about the quality of education to students and employers[2]. The rapid development in internet technology became one of the main factors in such dramatic changes. ICT fundamentally changed the practices of not only business and government but also the education sector[3]. The rapid advancement of new technologies in the field of ICT allows information to be gained more conveniently[4].

Problems related to the information technology in the education sector are resulted from the complexity and challenges of the management changes that can disrupt the educational process[5]. The access to internet services can now be done through various equipment, especially smartphones that have become the needs and lifestyles of students. Mobile information systems expand the possibilities of when and where to do learning. In the field of education, the number of academic institutions has developed and offered mobile information services. This development is supported by various policies from the government as well as on the basis of the needs of each university in accordance with the era of the industrial revolution 4.0 and society 5.0. There are more mobile-based apps which can be accessed via smartphones. They also offer students several valuable and qualified content[6].

The conversion from traditional or face-to-face services to paper-less shows that electronic network-based information resources are experiencing rapid growth[7]. In online environment, students seek support, information, or guidance in the learning process[8]. In the online learning process, students often access course schedules and subject matters provided by lecturers and news from universities[6]. Various studies have shown that Social Network Analysis (SNA) can be very effective in studying student interaction in an online context in college[9]. Network analysis is used to study a variety of topics, including the flow of information across social

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systems as in the diffusion of innovation; semantic relationships between concepts; sharing knowledge, organization, and management issues; small group interactions, including in the context of computer-powered collaborative work; patterns in social and scientific communication networks, including websites, social media sites, scientific collaborations, and citation patterns; and social support relationships[10]. Social network analysis is a large and ever-evolving research framework on the measurement and analysis of relational structures[11]. Network analysis is a new approach in research in the field of education[12]. The new approach will provide valuable insight into how learning occurs in many different contexts and at different levels. The research context used in this study is the use of information systems that can be accessed online by students at Universitas Gunadarma. This study aimed to look at patterns of using digital locker services with Ucinet application software and visualization of their patterns in graph form using Netdraw software.

Globalization and the speed of information encourage students to understand and have the ability to follow these developments through information and data[4]. Electronic-based networks have brought about a broad transformation in terms of information flow on universities[7]. One of the roles of information systems in education is to ensure that universities can provide the necessary information when needed[13]. Student information systems are one of the main systems to facilitate the management and development of universities. Higher Education Institutions collect and manage all student data with the help of the Student Information System to provide meaningful information that affects the decision-making process[14]. Pedagogical reflections on ICT should focus on how these resources can provide benefits to students[15].

The extraordinary growth of the higher education sector has created challenges in the system of its administration. The three main functional areas of information administration that are critical to the management of higher education institutions include student administration, staff administration, and general administration[16]. In the context of the university management, administrative management is often referred to as academic administration. The obstacles in the effective management of academic information systems include: diversity and heterogeneity of information technology solutions; differences in student mobility flow patterns; diversity in personal data protection policies; and no particular standard in data exchange[17].

Research on SNA has become a topic of interest in some disciplines, from sociology to marketing, entrepreneurship to international business[18]. The definition of Social Network Analysis (SNA) according to Tsvetovat & Kouznetsov (2011) is: "Social Network Analysis can be described as a "study of human relationships by means of graph theory"[19]. SNA is a growing field of research on the measurement and analysis of relational structures[11]. SNA views social relations in terms of a network theory consisting of nodes and ties. Ties are often referred to as edges, links, or connections. Nodes are individual actors in a network, and ties are relationships between actors[20]. Network consists of actors who represent individuals, organizations, programs, or other entities[21]. Although SNA has roots in anthropological and ethnographic research, the development of SNA is now directed at the mathematical nature of social networks by utilizing graph theory and statistical analysis[22]. SNA initially had anthropological and ethnographic research roots, but now its development is focused on the mathematical characteristics of social networks using graph theory and statistical analysis[22].

II. Material And Methods

The method employed in this research is Social Network Analysis (SNA) by using Ucinet software for matrix data processing. A matrix is defined as 2 modes if the rows and columns show the different sets of entities, e.g. rows representing people and columns are related to organizations.[23] Data collection using online quarries on google forms distributed in a chain to 587 students of Universitas Gunadarma. The main question is the frequency of using service features on student digital lockers (studentsite.gunadarma.ac.id). The frequency is further converted to a binary scale of 0 for those who never or rarely use the service feature on digital lockers and 1 for those who access it frequently. The results of the conversion of such data are, then, presented in the form of a matrix. In the matrix, the columns indicate the features of the services, and the rows indicate respondents. The matrix is then processed using software, called Ucinet and NetDraw. The network type uses a 2-mode network which is named graph theoretic layout. The 2-mode graph illustration used in this study can be seen in Figure 1.
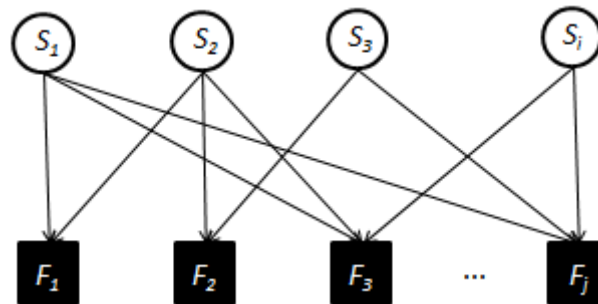
Figure 1. Matrix with 2-mode network model

S_i is a matrix that has rows indicating the number of students as respondents. F_j is a matrix that has indicating the number of service features on the academic information system. The nine features of the information system services can be seen in the main page. They are news from the university, news from Bureau of Academic and Financial Administration, announcements from lecturers, course schedules, assignments, Grade Point Average (GPA), digital student portfolios, and certificates.

III. Result

The first stage of data processing is encoding the results of the survey to 587 students into an excel format that is ready to be processed by Ucinet. Social Network Analysis uses UCINET software which has the ability to analyze various network parameters, such as: centrality size, subgroup identification, role analysis, basic graph theory and permutation-based statistical analysis[24].The menu of the Ucinet software can be seen in the following figure 2.
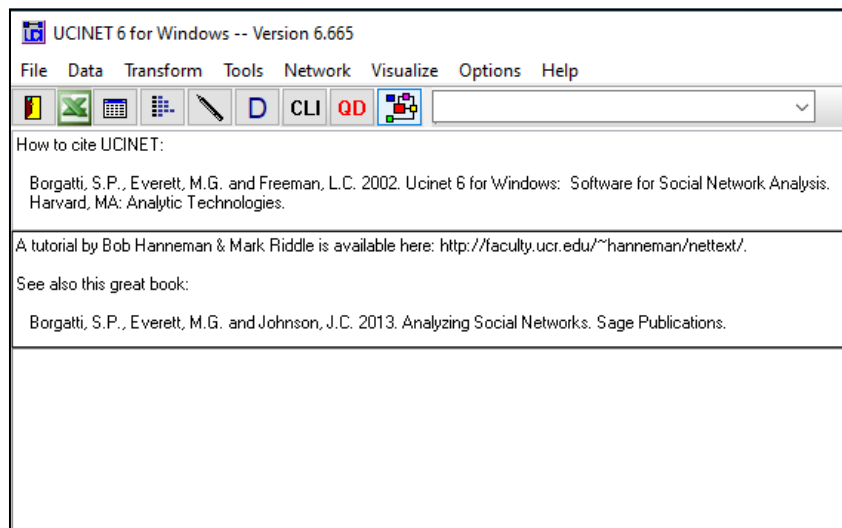

Figure 2. Ucinet Software

The graph used in this study is a two-mode graph that shows the patterns of relations of each respondent to the types of academic information system service features that consist of 9 features. They are namely Homepage, University News, Academic News, News from Lecturer, Course Schedules, Course Assignments, GPA Access, Digital Portfolios, and Reference Letters. The service features are shown in boxes and the respondents are shown in circles. The graph visualization processed by NetDraw is presented in figure 3. Netdraw is one of the most widely used software for visualizing social networks and has strong analytical capacity[25]. The type of graph used is a graph theoretical layout with a measure of centrality using degree centrality. The visualization of network uses four types of layouts, namely: Graph Theory, Principal Component, Gower, and Circle.

Graph Theoretic   *Principal Component*

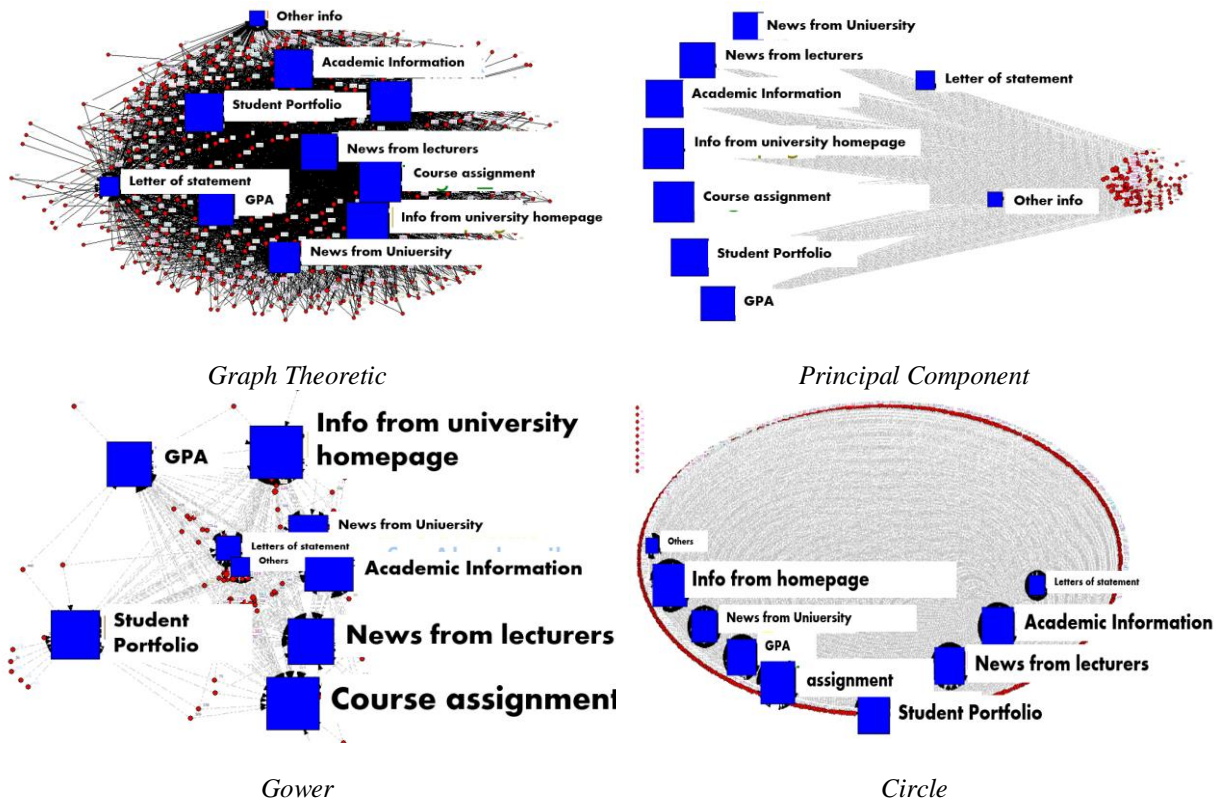*Gower*   *Circle*

Figure 3. Four types of layouts for graph visualization in Netdraw

The result of service popularity based on the survey is as follows: the Course Schedule (degree centrality: 342), Course Assignment (306), Student Portfolio (264), GPA (250), Academic News (227), News from Lecturer (227), Homepage News (209), University News (146), and Reference Letters (115). Another result of the survey is the frequency of the differences using digital lockers in terms of gender. The graph displayed using the graph theoretical layout is presented in figure 4.
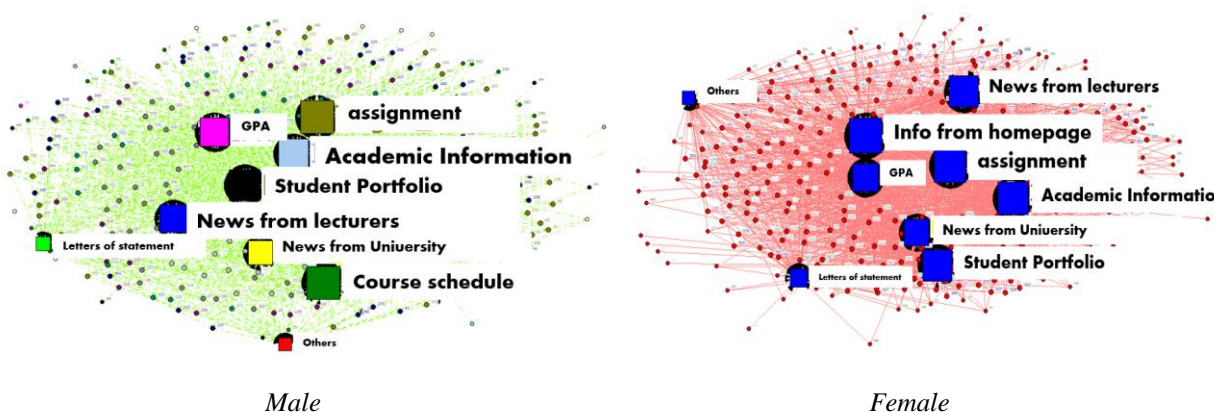

Male   *Female*

Figure 4. Frequency differences in the of use of the digital locker feature based on gender

IV. Discussion

The digital locker system at Universitas Gunadarma is more popularly known as Studentsite. The system can be accessed at the URL address http://studentsite.gunadarma.ac.id. The existence of the system allows Universitas Gunadarma to apply the concept of one-stop services. This is a portal that can be accessed by all students. The digital locker is integrated to the academic information system. In this system, it is also built a digital student academic performance track record system called a digital student portfolio. Student digital portfolio is basically a record or track record of students' academic activities, both in the classroom and outside the classroom. It covers students' activities from first semester to the final semester. With this portfolio, students' activities can be monitored in terms of their success in participating in the lecture process, including the learning process outside the classroom by using various ICT-based learning resources.

The availability of mobile services allows students to access various features of academic information system services in more convenient ways. The Class Schedule is the most visited feature by most respondents. The other two features which are also frequently visited are Assignments from Lecturers and Student Digital Portfolios. The most popular service features are directly related to the learning process so that most students frequently access these three features. Male respondents tend to frequently access these three categories of academic system services, namely: (1) Course Schedules and Assignments, (2) Information and GPA, and (3) News and general administrative services at the university level. The patterns of using the academic system services above shows that female students tend to frequently access these three groups, namely (1) News and general administrative services, (2) Information and learning activities, and (3) GPA.

Internet connectivity or internet access is the main supporting factor in the successful implementation of mobile academic information systems. This is due to the fact that most students have subscribed to the internet providers at home and access the internet via cellular. This will bring the frequency of accessing information system services has become more intensive. This is in line with the statement of Bytheway (2017) that connectivity is the main factor that drives the change and complexity and the younger generation is now constantly connected to the internet and the World Wide Web. Another factor that supports the implementation of the information system is the completeness and accuracy of the information[5]. The internet users are interested in seeking up-to-date and detailed information to make effective decisions in the learning process[14]. This academic information system is designed using a convenient and mobile-friendly navigation. Students can quickly choose various services and types of academic information. Students accessed several features in a web-based system services and many pages of the websites. However, they did not explore the websites in details during their visit[26].

One of the most interesting features of this information system is the availability of a digital student portfolio. The student portfolio shows the records of the student activities outside the classroom that support the learning process. These activities are in the form of seminars, workshops, training, student activities, and various productive and creative achievements or activities outside the classroom. Each student reports their activities through this information system. The portfolio is used in several courses and this is also used as an assessment criterion to pass the courses that apply adaptive learning methods towards the soft skills development. The application of the learning method using e-portfolio is still rarely implemented in Indonesia. According to Gewerc et al. (2016), the teaching process using e-portfolios still faces big challenges, including the use of the information technology[27].

V. Conclusion

Ucinet software used in this study is to prepare a data table in the form of a matrix consisting of two dimensions. The first dimension is student respondents, and the second dimension is the digital locker service features which includes 9 (nine) types of services that students can access. This study uses 4 (four) network layouts, namely: Graph Theoretic, Principal Component, Gower, and Circle. Based on the degree of centrality, this study produces visualization of service features in which the sizes differ according to the value of the network size. The node with the largest size indicates the service which is most frequently accessed by students, namely the Course Schedule. In addition, the other two features which are frequently accessed by students are Assignments, and Student Portfolio.

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