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Undergraduate Students Academic Progress Reporting Using UPReS: A Feed Forward Approach

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ABSTRACT

Academic performance monitoring is traditionally based on feedback approach. A disadvantage of this approach is that any remedial action would be too late to be implemented. Given that higher education institutions are striving towards achieving graduate on time objectives, an innovative feed forward approach is highly needed. Undergraduate Progress Reporting System (UPReS) is an innovative monitoring and reporting system to monitor academic performance among undergraduate students using electronic spreadsheet. UPReS enables users to forecast academic performance and to identify under-performing students which allows for early intervention programs to be implemented. Using qualitative methodology, this research found that UPReS is able to overcome the limitations of current academic progress monitoring system and offers benefits to students, lecturers and higher education institutions.

Keywords: *Innovative, feed forward, academic progress, electronic spreadsheet, progress monitoring.*

1.0 INTRODUCTION

Monitoring of academic progress of undergraduate students are of paramount importance to universities and to the students themselves (Sencan & Karabulut, 2015; Ogor, 2007). While universities often associate the overall effectiveness of the curriculum offered through students' academic achievement, students also strive to achieve good grades for their own future employment (Rannveig et al., 2017). In Malaysia, the universities particularly public universities have the challenging tasks of ensuring that their graduates succesfully complete their graduation package within the specified time frame (Othman et al., 2015).

Prior studies (e.g. Wagener, 2016) suggest that students may not graduate on time due to the difficulty to adapt to the higher education life compared to school environment. Othman et al. (2015) noted that several factors affect the success of students to complete their studies such as (1) lecturers' support, (2) job prospects, (3) alumni/senior students' support, and (4) counselors' role. However, more importantly, failure among students to graduate on-time may also be due to the ineffective monitoring of academic progress and performance throughout their studies. Most of the academic performance monitoring is based on traditional feedback approach using final examination grades (Wagener, 2016). This approach focuses on monitoring students' academic progress after they have undergone their final examination. A disadvantage of this approach is that any remedial action would be too late to be implemented.

One way to eliminate the problem is to adopt the feed-forward approach in academic progress monitoring to replace the existing feedback approach. In discussing students' preference on getting comments provided to them on drafts prior to the actual assignment submission, Ghazal et al. (2018) noted that students prefer having feed-forward instead of feedback by their instructors. In much the same way, lecturers and students need feed-forward assessment system which involves real-time academic progress monitoring. To reach this goal it is essential for the lecturers to have tools to help them identify students who are at risk academically and adjust instructional strategies to better meet these students' needs (Safer & Fleischman, 2005). Pettey (2007) noted that academic progress monitoring can be conducted on individual or class basis. Regular academic progress monitoring would facilitate the students and lecturers to determine whether they are progressing appropriately to the typical instructional program and to help design more effective programs for students who benefit inadequately from typical programs (Pettey, 2007).

Despite the call for using feed forward approach, there is still limited studies which focus on using this approach. Hence, the nature in which such approach can be adopted and the way in which it delivers the benefits to students and lecturers are still unclear. Therefore, this study aims to fill the existing gaps by examining the impact of an innovative monitoring tool known as Undergraduate Progress Reporting System used to monitor academic performance among undergraduate students. UPReS is a feed forward control approach to monitor academic progress using electronic spreadsheet. Apart from monitoring purposes, UPReS can also be used to forecast academic performance and as such it serves as a useful tool to identify under-performing students and allow for early intervention programs to be implemented.

2.0 LITERATURE REVIEW

Graduate-on-time (GOT) requirement among students have become a major concern among higher education institutions including in Malaysia. Aina et al. (2018) suggests that on-time graduation is viewed as one of the discriminating criteria for employee selection during recruitment process. This implies that students who graduate on time have better chances of being employed compared to those who experience delayed graduation. Students' success in securing employment upon graduation not only prevents unemployment among the students but also reflects relative success of the university itself. For example, many higher education institutions in Malaysia incorporate graduate on time as one of the key performance indicators to monitor its overall performance. One of the ways to ensure students graduate on time will be to monitor their academic progress and performance on a regular basis. In many higher education institutions, a typical scenario would suggest that at the end of the semesters, the lecturers are required to inform the students on their continuous assessment marks via tests, quizzes, presentations, projects and assignments before they sit for their final examinations. A problem that may arise in this situation is when the grades are not made available to the students in a timely manner. As a result, the students would not know their performance well in advance before their final examination starts. This may also mean that intervention programs designed to improve students performance could not be conducted. Similarly, the students may have a vague idea of how well they have performed during the semester and may not be able to pro-actively mitigate their poor performance. Intervention programs that need to be conducted for poor performing courses may only be implemented in the following semester. In other words, the current practice failed to addressed the poor academic performance of the students in time before they sit for their examination. It also means that

intervention program commonly designed for poor performing students will not be able to be effectively implemented for the benefit of the intended students. At best, the feedback approach would lead to improvement for future students but quite often it would be too late for current students.

Feed-forward concept has been largely discussed in the science and engineering literature before being adopted in the social science field. In particular, management studies use the feed-forward concept in examining organizational performance. The concept of feed-forward can be simply viewed as a system that measures disturbances and subsequently account for these disturbances before they have time to affect the system. In organizational studies, it is suggested that managers need an effective control system that will inform them well in time for corrective action (Kaplan & Norton, 1996). Relying on the feedback from the output of a system is not adequate for control to be achieved (Nishimura, 2019). This is because feedback control only acts as a little more than a post-mortem for which no meaningful action can be taken by managers to change the past. As such managers require feed-forward control to implement pro-active actions to avoid future difficulties. Ghazal et al. (2018) performed an experiment to examine the feed forward approach to students' performance. They found that the performance of students who were given feed forward comments on their assignments were better in terms of increased overall assignment and academic writing scores. The findings also reflected better results in terms of the (reduced) frequency of visits to their instructors for clarification of written feedback.

Drawing on the importance of feed forward academic monitoring approach, this research focuses on an innovative application of technology to support the goal of achieving graduate on time goals. Innovation implies newness (Johannessen, Olsen, & Lumpkin 2001) which involves complex and uncertain processes (Van de Ven, 2018). In general, innovation is referred to as development, modification and creation of new products or services, processes, or technologies with the intention of bringing up the newness of economically viable areas, which in turn will be translated into efficiency and profitability (Gunday et al., 2011). Innovation can be divided into three main types, via administrative innovation, product and process innovation, and technological innovation (Ax & Bjørnenak, 2005; Damanpour & Evan, 1984; Kimberly & Evanisko, 1981; Abernathy & Utterback, 1978).

The current research innovation is regarded as technological innovation in which it involves a system to monitor academic progress on a pro-active basis using real time approach. This type of innovation enables students and lecturers to gauge students' future performance. The focus is on what needs to be done to enhance

learning, both directly through the effort resulting in an indirect support and motivation (Zhanjun, Weifeng & Jiangbo, 2016).

3.0 METHODOLOGY

This study focuses on one of the public universities in Malaysia as a qualitative case study to examine the academic progress monitoring of its undergraduate students. The university is chosen due to its typical environment in which feedback control approach is implemented in monitoring academic progress. A series of semi-structured interviews with average duration of 30 to 40 minutes was conducted. The interviewees selected among the students who were taught by the researchers during the period of study.

3.1 Research Process

The present research uses a qualitative approach to scientific inquiry in which the research process consists of 5 stages as shown in Figure 1.

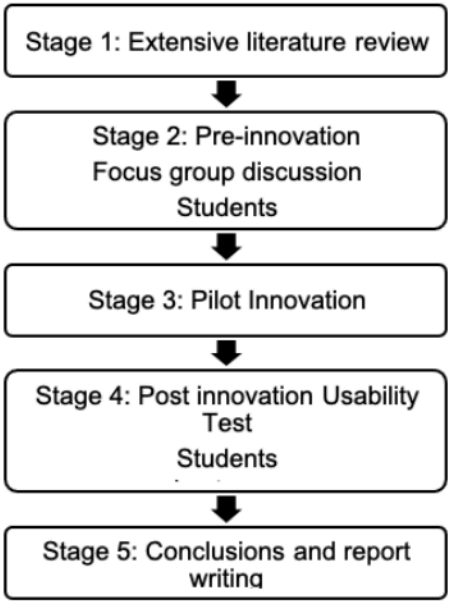

Figure 1: The research process

In Figure 1, the first stage involves extensive review of the literature. This is followed by a pre-innovation stage in stage 2. During this stage a focus group discussion was conducted in order to obtain initial feedback on the current academic progress monitoring system. The discussion involved students who were invited on a voluntary basis to participate in the discussion. These students have completed their 14-week lecture sessions and were revising their lessons for their final examination. The discussion session lasted for one hour and the discussion was audio recorded with consent of the participants. A transcription was later prepared and analyzed. An overall view was obtained by reading the transcribed interviews. The data analysis process involves data reduction by categorising results into themes and subthemes through thematic analysis. Subsequently the data was coded. Throughout the data analysis process, several rounds of coding have been conducted resulting in the final refined coding scheme. categorising the results into themes and subthemes through thematic analysis. Finally, a refined coding scheme was established. Based on this categorisation, the data was interpreted and reported. The analysis revealed important findings which later became the critical input in developing the innovation tool, UPReS.

In the third stage, the tool was piloted through a demonstration to two separate groups i.e., a group of students and a group of lecturers. This separation is done in order to avoid biasedness of feedback gathered from each group as well as to ensure objectivity in responses from both groups. The demonstrations were conducted specifically to gain feedback on the usability and effectiveness of the tool. While a focus group discussion was held for the student group, feedback from lecturers were obtained through semi-structured interviews in stage 4. The feedback serves as an important input for further improvement and redesign of the system. Finally, in stage 5, the findings were analysed and conclusions were drawn. The respondents of the research consisted of both students and lecturers in one of the public universities in Malaysia. The students were enrolled in an undergraduate program in one of the campuses of the university.

3.2 Undergraduate Progress Reporting System (UPReS)

Undergraduate Progress Reporting System (UPReS) is designed to monitor and report the learning progress for each individual student as well as for an entire class. This system is developed to help students overcome their eagerness of getting to know their ability to obtain certain grades for their final examinations. The current practice of conveying assessment marks is done through posting a plain spreadsheet at the end of semester showing on-going assessment marks namely quizzes, tests, assignments, case studies, projects and so on. There is little opportunity for

intervention made by most lecturers to help improve their students' performance. Although some lecturers might take an initiative to introduce educational 'clinics' specifically intended for weak students based on certain assessment, this effort is mainly voluntary and is commonly based on past students performance taking the same course. UPReS is designed to improve the current monitoring system with a simple yet effective system to gradually monitor students' performance. It gives a solid idea to the lecturers before they can start to intervene and evaluate the students' academic skill. Besides, it provides opportunity for both students and lecturer to discuss necessary actions for improvement.

The principle behind this innovation is the adoption of "feed forward" control approach whereby academic failure risks can be identified and mitigated before it occurs. In contrast to the conventional feedback control approach, the students' academic performance can be forecasted before their final examination. In this way, students are made aware of their strength or weaknesses and as a result would likely prompt them to take remedial actions to get better grades. Another unique feature of the tool is the ability of simulating students' grades using their current continuous assessment marks. This provides an opportunity for the students to forecast realistically several expected grades based on their current achievement. Due to its ease of use and adaptability, UPReS can be used at any time during the study period while the course is still ongoing. It also helps the students to allocate their time more wisely in their effort to achieve a targeted grade.

UPReS is friendly to the user with straightforward, clean, and well-organised interface. Its components include the Dashboard, Individual Performance and Raw Data. Dashboard is designed for lecturers as a reporting tool in tracking and make informed decision based on students' performance. Ideally, dashboard simplifies complex data into data visualisation in a form of graphs and tables. The Individual Performance component of UPReS is meant for students to check their assessment marks and simultaneously able to project their targeted final examination marks and grade. Besides, this system provides a Print button for quick printing. Lastly, Raw Data component is provided for lecturers to key in ongoing assessment marks to be manipulated in order for UPReS to generate students' performance report individually or group basis.

4.0 FINDINGS

This section presents the findings before and after the implementation of UPReS to the respondents.

4.1 Pre-innovation

The findings showed that there were limitations regarding the current system of monitoring student academic progress experienced by the students. This is mainly due to the absence of techniques in which the students are able to forecast their future grades in the final examination. Figure 2 displays the process involved in the existing academic performance monitoring system.

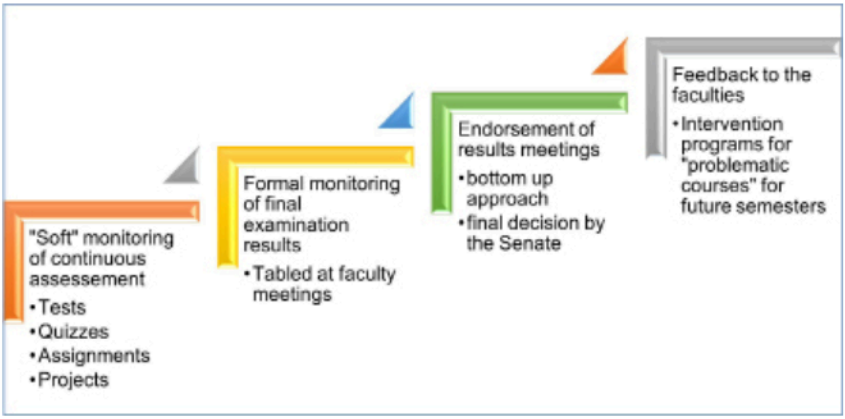

Figure 2: Feedback loop of academic performance monitoring

As shown in Figure 2, before the students sit for their examination, their academic progress is only informally monitored by lecturers throughout the semester. The regulation of the university stated that the students must be informed about their continuous assessment marks prior to the final examination. However, there is no specific guideline on how the students would be guided beyond that. Problems also occur when there is delay in receiving the carry marks as sometimes experienced by the students. Although there is no violation of regulation among the lecturers, this may cause difficulty among students to forecast their score in the final examination. Hence, the absence of proper reporting of academic progress was noted. The findings also indicated that for low achievers or weak students, there is a need to discuss academic progress with lecturer on a regular basis as their study progress. Currently, the academic advisors are appointed with the task to guide and mentor the students under their responsibility. However, there is no formal mechanism on how the monitoring should be done.

Within the current system (Figure 2), the academic performance of students is formally reported at both the faculty and university level following each final examination sessions. Among the outcome of this process in the identification of intervention programs by program coordinators and deans for the future semesters.

The aim of the intervention programs such as education clinics, revision sessions and mentoring system is to overcome low academic performance in the coming semesters. In effect, the current system is based on a feedback approach to monitor academic progress. One of the disadvantages of such approach is the untimely nature of the proposed intervention programs as there is a failure to take actions to boost academic performance before the final examination.

Based on the focus group discussion with students, several problems with the current academic progress system are noted. Firstly, there were occasions when students are not able to gauge their future performance before the final examination. One of the students commented:" "…it is unfortunate that the students could not "target" for the paper (before the final examination" while another noted that "…I do not know how to target my score." The students also highlighted that knowing how to predict their scores is important in order to have realistic expectation of their future grades. As commented by a student: "I was targetting for at least a B or a B+ but when it came out with a C+, I was quite shocked."

4.2 Post-innovation

During the pilot innovation stage, the respondents were introduced to UPReS and shown their respective progress report. The reports were printed and distributed to respondents during the session. The implementation of the feed forward approach to academic progress monitoring in this pilot stage can be depicted in Figure 3.

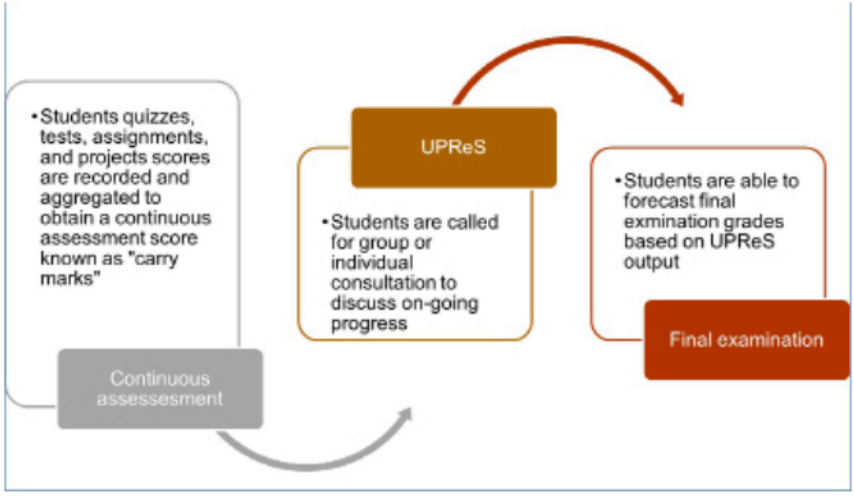

Figure 3: Implementation of UPReS

Following the pilot innovation of UPReS among respondents, a usability test was conducted among both students and lecturers in order to obtain feedback on the usefulness of UPReS. Several benefits of UPReS were highlighted by the respondents. Firstly, the UPReS system offers benefits to the students in many ways. Among them is (1) the generation of a progress report for students on an individual basis, (2) UPReS can be used as a tool for motivating weak students to achieve better score in final examination, (3) it also provides a means for students to set realistic expectations by knowing the all possible grades they can achieve. Secondly, the system benefits the lecturers by (1) enabling them to easily identify students with potential academic failures as well as (2) to monitor students progression on a real time basis. Another benefit of UPReS to lecturers is that the progress report can be used as a tool for motivating weak students to achieve better score in final exam. This is because weak students may easily lose motivation but the situation may be improved by discussing possibilities for them to achieve acceptable grades and thus help them to strive for better grades. In addition, the report generated from UPReS provides data visualization that helps lecturers and students to interpret student academic performance effectively. Moreover, the use of dashboard in the academic progress report is consistent with the recent trends in industrial revolution 4.0. The system uses visuals of output as illustration of the performance data.

According to Petty (2007, p. 37), visuals of data would allow for:
"data be kept by the teacher in the form of a graphic record, where teachers are able to visually track student progress by graphing the student's baseline, different interventions tried, and rate of growth. In a glimpse, the teacher is able to see whether progress is being made. If progress is not being made, then the teacher can make adjustments to the interventions. If progress is being made, then the teacher can see the growth trend and estimate whether the student is on target to catch up with the other students."

Thirdly, this system provides advantages to higher education institutions particularly in supporting the effort to achieve graduate on time objective. This is because a more effective and systematic intervention programs would like to prevent academic failures to occur.

The usability test also involves interviews with lecturers. The views of the lecturers were found to be consistent with the interview findings from the students. During the demonstration of the system, the lecturers were given the hands-on opportunity to test the UPRES. Positive feedback were received whereby on average the duration to search student record is around 10 seconds. As shared by one of the

lecturers.

" This is what we are looking for all this while, this UPRES will help the students to know their current standing and if they should change their aims."
In addition, UPReS was found to be useful in giving students the opportunity to plan for their revision before the final examination. From the results, it is recommended that academic advisors and lecturers to use UPReS as a systematic means to plan for academic intervention program such as "clinics" or mentoring programs. Figure 4 shows a proposed intervention model for lecturers in dealing with subjects with potential high failure rates among students.

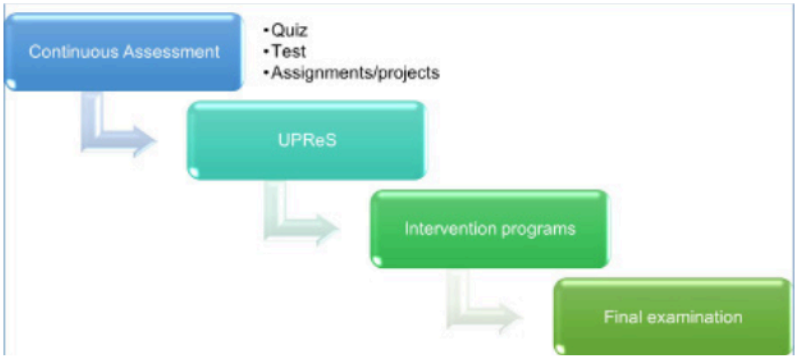

Figure 4: A model for feed forward academic monitoring

Based on this model (Figure 4), the students can be informed early on their on-going progress during their study period using UPReS. This model suggests that the lecturers and academic advisors would be able to monitor their students' performance and subsequently plan for more effective intervention program. This is because the intervention programs will be more suited to the needs and expectations of the students. Additionally, the feed forward control loop (i.e., continuous assessment - UPReS - Intervention program) can be repeated even after a single assessment such as a quiz or a test before the final examination. Hence, UPReS represents a system to monitor academic progress on a pro-active basis using real time approach and uses visuals of output as illustration of the performance data. This is in line with Reimann, Sadler, and Sambell (2019) and Rizzuto and Balodimou, (2019) a software or apps that serves as feedback platform facilitates tutors and students in forecasting the students performance. Following the progress monitoring, various intervention program can be implemented to avoid poor academic performance in the final examination. The intervention program can either (1) faculty-led intervention programs conducted for students involving the whole class or (2) focuses on students facing difficulties specifically.

5.0 CONCLUSIONS

Consistent with Hill and West (2019) and Petty (2007), this research suggests that students prefer having feed-forward instead of feedback approach in academic performance monitoring by their lecturers. In addition, this research supports the usefulness of applying modern information technology in the field of higher education particularly in monitoring students' academic performance (see Zhanjun, Weifeng & Jiangbo, 2016). The Undergraduate Progress Reporting System (UPReS) provides a platform for students to forecast future academic achievement and allows students to be aware of their on-going progress. This innovation can also be used as a means for motivating weak students to achieve better score in their final examination. UPReS enables lecturers to monitor students progression on a real time basis and identify those with potential academic failures. In addition, the report generated from UPReS provides data visualization that helps lecturers and students to interpret student academic performance effectively. Moreover, consistent with Jokhan, Sharma and Singh (2018) this innovation benefits higher learning institutions through forecast of results which facilitates academic advisers to address students' poor academic performance. UPReS also provide a systematic approach to take remedial action such as "clinics" and mentoring system for students. Therefore, this innovation offers benefits to all relevant stakeholders which include students, lecturers and higher learning institutions.

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