

Scheduling in an unknown, diverse consumer world! Different challenges, different response!

Paul Harrington · Geoffrey Forster

Abstract Resource scheduling within the Higher Education environment has been focused on improving the utilisation of ever decreasing resources to construct a schedule that delivers an optimised use of resources in the delivery of a fixed set of outcomes.

With the Higher Education Sector competing globally for a more demanding, consumer oriented, technology savvy group of students institutions are having to offer more student choice. This student demand and flexibility of choice presents challenges to the current generation of scheduling tools and to the working practises of scheduling departments.

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Introduction

Resource scheduling within the Higher Education environment has been focused on improving the utilisation of ever decreasing resources to construct a schedule that delivers an optimised use of resources in the delivery of a fixed set of outcomes.

With the Higher Education Sector competing globally for a more demanding, consumer oriented group of students, institutions will need to offer more student choice and provide better advice to students. This student demand and flexibility of choice presents challenges to the current generation of scheduling tools and to the working practises of scheduling departments.

The pace of change in the HE sector, all over the globe, has been so fast and transformational in the recent years that the usual responses on the edges and the surface will not suffice. We believe that a re-conceptualization of what

Mohamad Djahanbakhsh, CEO and Geoffrey Forster, Director
Scientia

a next generation planning and scheduling system should provide is required, and the paper describes some of these new concepts.

Scientia is the established market leader in timetabling and resource scheduling solutions for the Higher Education sector worldwide. Our Syllabus Plus products provide solutions to the problems faced by organisations in optimising their assets and resources, most notably time and space, and in a way that best meets the needs of staff and students.

The approach for these solutions has been to define the problem to be solved as early as possible, providing as much concrete information for the scheduling engine to use to create a solution. This requires the working practises within the University to capture requirements early. With the introduction of greater student choice and more emphasis on student satisfaction, these requirements are more fluid until much later in the scheduling process.

Planning, Scheduling and Allocation is business critical with the capability to improve revenues and reduce costs, and will be used by everyone at the institution every day of the year. This will require more effective integration with the other core business systems like SIS and LMS.

Trends in HE that will impact planning and timetabling

Cost pressures to get more for less

The reduction in HE budgets seen in the Western World is continuing to drive the need for further optimisation of resources, not only within the academic schedule, but making maximum use of resources through commercial enterprise.

With these tightening budgets systems will need to be capable of effective cost modelling and scheduling decisions will not only be about meeting the needs of staff and students but also cost effectiveness. These budgetary constraints will have an impact on staff workload planning, with institutions looking to ensure that they have the right balance of research, lectures and teaching. This will be important for attracting the best lecturers and invaluable funding for research.

Enhancing the student experience

The cost of their education and career opportunities are important to many students. They want to know that they will graduate by a particular date, with the courses that they wanted, that fit around their requirements. This could include features such as employability, previous success rates of particular study paths and other advice and guidance.

They expect the university to create a schedule of classes that satisfies their academic requirements and allocates them to a set of classes that takes their personal preferences for attendance into account.

Students may have gaps in attendance in order to clear debts or take internships. Some students may prefer a 2-year degree that condenses 3 years of study into 2 years, and take no holiday.

Short courses for students are offered throughout the academic year and students may take courses from other institutions.

MOOC's & blended learning

Massive open online courses (MOOCs) are a revolutionary element of higher education today. Institutions may embed MOOCs from other institutions in their awards. Scheduling resources for virtual courses to fit the demands of students from around the globe presents a fresh and exciting challenge.

Blended learning will increase the demand for new meetings at short notice.

- Classes offered off campus.
- Blended learning.
- Flipped lectures.
- Classes offered across time-zones.

Rapid change & unpredictable demand

Student meetings are increasingly planned and scheduled at short notice. The requirement still remains that there is an efficient use of resources. This lack of certainty around requirements presents significant challenges to both the systems and working practises of scheduling departments.

Features of a Next Generation planning and scheduling system

Undoubtedly the next generation set of solutions will be based around new and emerging technologies, taking advantage of the capability of the cloud for high computational power that can flex on demand. Collaborative technologies will enable the scheduling departments to work more efficiently with academic departments while designing the schedule, helping to make decisions quickly and effectively.

The system needs to be able to continually optimise throughout the scheduling cycle, with different rule sets firing at differing points of the cycle. It needs to be able to cope with change, recognising that change happens but has to keep disruption to a minimum.

Some key factors in delivering that solution are explored below.

Smarter Anticipation of Demand

One approach to reduce the amount of change in the requirements could be to use past data to better anticipate demand. Using the information about pathways that previous students took on programmes would enable pseudo class sizes to be created and space provided for students to take the course. This of course is what academics will say is done when planning class sizes, in reality this is more likely to be a constraint of supply and restricts the flexibility of choice that is required to meet student satisfaction.

The use of guided allocation when collecting student requirements would also enable the problem to be modelled more effectively. The presentation of information to the student while they are selecting the courses they wish to undertake. This information could include data such as success rates of previous students and pathways that previous successful students took. Collecting students' preferences for courses that meet requirements such as childcare arrangements as early as possible also allows for improved modelling and reduces the potential for change.

An exciting opportunity presents itself in the use of big data to anticipate real world demand for specific programmes. The use of inference engines to analyse the data points such as employability, popularity of subject, scarcity of qualified people (skills gap), number of offerings, career paths etc. provide an opportunity to the university to increase competitiveness by providing programmes that meet real world demand. This anticipation of demand will enable management to more effectively manage the long term decisions of manpower planning. This anticipation ensures that the right mix of staff is recruited to ensure that the courses that are in highest demand are able to meet the demand.

Early Planning or Lazy Allocation?

As has been seen allowing student choice creates uncertainty in the scheduling process, the most common approach to solving this problem is to complete the planning as early as possible in the process presenting a clear statement of the requirements to be scheduled.

Where this isn't possible the challenge is "to introduce the minimal amount of perturbation into the solution already created". This challenge can be further refined as "to introduce the minimal amount of perturbation into the published elements of the schedule".

This redefinition of the problem allows the use of "lazy allocation" of resources to any activity to be scheduled. This lack of eagerness to resolve the problem fully early in the scheduling process presents greater degrees of flexibility when requirements do change late in the process. The trick is to allocate the minimum resources required and "reserve" types of resources. This ensures that a theoretical solution exists for the schedule created and allows for prob-

lem resolution without being constrained to specific resources too early in the process.

Scheduling for MOOCs

What happens when time and space become almost limitless? When lectures no longer need to be delivered within the boundaries of a classroom or even attended at a set time. The challenges for scheduling MOOCs will present a different challenge with very different demands on access to resources that current systems are not designed to meet.

While lectures may no longer need to be scheduled, access to high quality support will be required to students looking for a blended approach to learning and the Universities that can deliver this will be those most successful in recognising the commercial opportunity that MOOCs undoubtedly bring. This access could be in the form of physical face to face meetings with tutors or online meetings with tutors and mentors. It will become important to consider factors such as geographical location and time zones to ensure accurate matching of students to appropriate resources. This matching of resources will be on increased data set sizes, it is not unknown for MOOC courses to have over 100,000 students.

This new challenge will require very different approaches to scheduling with simpler constraints but higher demand. This will require the matching of students' demand to available resources to be carried out in a just in time manner. This approach could learn much from the resource management of companies such as Amazon where meeting the demands of the consumer is the difference between survival or closure.

Conclusion

It is clear that the current generation of Scheduling Solutions have to evolve to meet the rapidly changing requirements in the HE sector.

The command and control nature of current solutions where certainty is required before an efficient and effective schedule can be created will not be able to meet the challenges of this new consumer focused, student experience led revolution. Systems that can adapt and manage large degrees of uncertainty and are capable of guiding the user and presenting solutions to the problems as they emerge will be the dominant successful solutions in this new diverse consumer world.

Scientia and Syllabus Plus

Syllabus Plus was released in 1991 and was the first commercial product that could generate an optimised schedule for an institution, taking into account human and physical resources and student course requirements. The Syllabus

Plus scheduling engine has hard constraints and preferences and provides multi-user cooperative scheduling, so it can scale to schedule the largest institution. Auto-scheduling uses a heuristic based upon the difficulty of scheduling each activity. Manual scheduling allows a scheduler to reschedule part of a schedule, and with the engine giving advice about the best way to make a change. Important additional products has been added to Syllabus Plus including: Award and course planning tools, staff workload management, student award planning, student self-allocation to classes, staff and student timetables, data analysis reports, and examination scheduling. Enterprise Syllabus Plus was released in 2008, allowing anyone at an institution to access the services that they were allowed to access from a web browser.