Scheduling – Avoiding Dead-Ends

Limacon Technical

38, Cheshire Road
London, N22 8JJ

limacon@btinternet.com
www.limacontech.co.uk

Table of Contents

I. **Idea** 2

II. **Dead-Ends** 2

III. **Mind the Gap** 4

- Scheduling – Initial Stages
- Scheduling – Final Stages
- Zigzagging
- Gap Distribution

IV. **About the Author** 8

Idea

When you schedule your first school timetable, there are various traps of which you should be aware, otherwise, after much time and effort, you may find yourself at a dead-end. This is the unfortunate position where a timetabler has no possible way to finish the timetable – yes, this can happen!

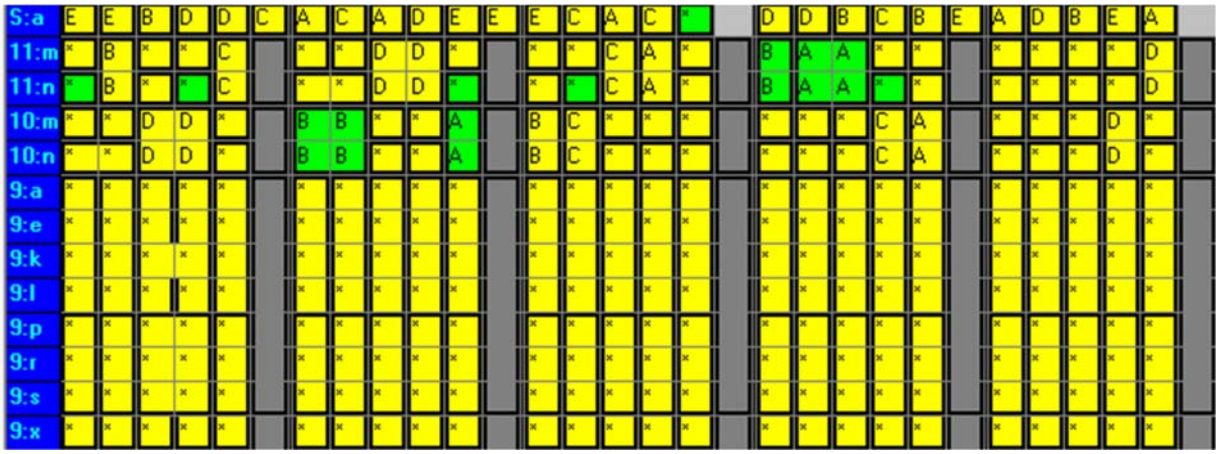
This article is devoted to one such trap which usually manifests itself towards the end of the scheduling process when a timetabler concentrates too much on scheduling blocks in the easiest time slots and forgets that, eventually:

ALL TIME-SLOTS MUST BE FILLED

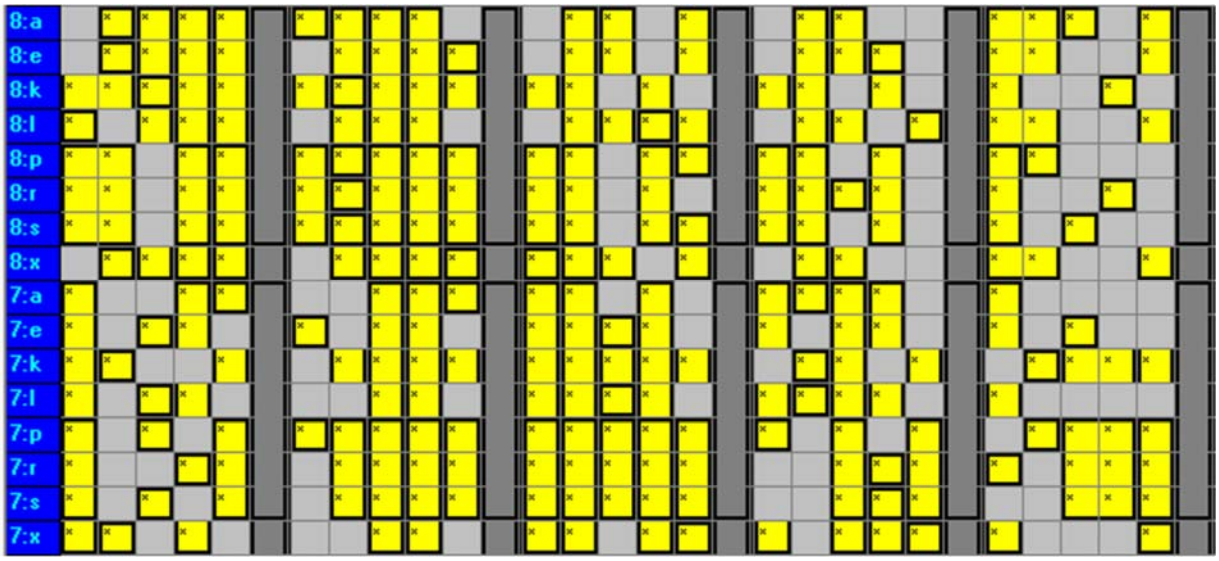
Dead-Ends

The following position was reached in an actual school timetable construction. The timetabler had correctly left the easiest blocks to schedule last, the large linear Year 8 and 7 blocks) but had worked for two weeks repeatedly scheduling and unpicking without getting close to a final solution.

To get an overview of his situation, I opened the ***Bands*** *menu in Nova-T6. I could see immediately that Years 9, 10, 11 and the Sixth Form had been completed (no grey gaps- see below).*



However, the linear blocks in Year 7 and 8 were yet to schedule (see below)



Ignoring the fact that the use of bands was particularly inefficient here, the remaining gaps (the grey squares) show where he was trying to schedule his last lessons.

Remember, the last linear blocks contain teachers from certain subject areas. In this case, the subject areas were:

- *Art*
- *Drama*
- *Music*
- *Geography*
- *History*
- *PSHE*
- *RE*

Looking at the diagram above, one aspect leaps out: most of the blocks scheduled up to this point have had their lessons concentrated on Tuesday and Wednesday leaving Monday, Thursday and especially Friday with far more gaps to fill.

On closer inspection

- *Monday – 23 gaps, 57 filled*
- *Tuesday – 18 gaps, 62 filled*
- *Wednesday – 17 gaps, 63 filled*
- *Thursday – 30 gaps, 50 filled*
- *Friday – 38 gaps, 42 filled*

Why has the week become so unevenly distributed? Because, when scheduling the other blocks in the Year 7 and 8 curriculum, the timetabler had simply chosen slots which presented the least problems!

Experienced timetablers will look at this diagram and point to the most likely cause of the problem - part-timers:

- *Fridays – the day most part-timers had off*
- *Thursdays – the second most common day to have off*
- *Mondays – the third most common day to have off*
- *Tuesdays and Wednesdays – the least common days to have off*

Of course, the Tuesdays and Wednesdays were the easiest to schedule, the Fridays the hardest. What makes the timetabler think he can now schedule the remaining lessons on the most difficult days? This is the essence of the trap:

The timetabler has neglected the gaps

Musicians know that the spaces between notes are as important as the notes themselves. This musician has concentrated on the notes and neglected the spaces between them!

*I just needed to ask the timetabler one question: how many teachers of Art, Drama, Music, Geography, History, PSHE and RE are you trying to schedule in these blocks and, out of these, **how many work Fridays**? The answer was 8. The next part of the conversation was difficult:*

On Fridays, you have

- *Period 1 – 3 gaps to fill, requiring 3 teachers*
- *Period 2 – 9 gaps to fill, requiring 9 teachers*
- *Period 3 – 9 gaps to fill*
- *Period 4 – 10 gaps to fill*
- *Period 5 – 7 gaps to fill*

I didn't need to point out that he had spent two weeks trying to achieve the impossible.

Mind the Gap

Scheduling – Initial Stages

As a timetabler, the fact that you are responsible for providing an activity of some sort for all younger students all of the time, should always be in the back of your mind when you are scheduling.

When deciding where/when to schedule a lesson or group of lessons, my technique is to have two targets in mind:

1. *Identify the most difficult blocks, groups, teachers and schedule these first*
2. *Identify the most difficult days and periods in the timetable and fill these first*

Which of the two takes priority at any point is a matter of judgement aided by experience but in my experience; many timetablers are good at 1 and only think about 2 when it is too late!

Before constructing a timetable, I like to have a firm grasp as to the relative difficulty each timetable day will pose. I simply count the part-timers' days off!

Code	1Mon	1Tues	1Wed	1Thurs	1Fri	2Mon	2Tues	2Wed	2Thur	2Fri
ARO	T	T	T	T	O	T	T	T	O	O
BAM	T	T	T	O	O	T	T	T	O	O
BMA	O	O	T	T	T	O	O	T	T	T
CPE	T	T	T	O	O	T	T	T	O	O
DMU	O	T	T	T	O	O	T	T	T	O
ECW	T	T	T	O	O	O	T	T	O	O
EDE	T	T	T	T	T	T	T	T	T	O
EED	T	T	T	T	O	T	T	T	T	O
HHD	T	T	O	T	T	T	T	O	T	T
HNA	T	T	T	T	O	T	T	T	T	O
JBA	T	T	T	T	T	T	T	T	T	T
JCD	T	T	O	T	T	T	T	O	T	T
TWA	O	T	T	T	T	O	T	T	T	T
JVL	T	T	T	T	O	T	T	T	T	O
LTA	O	T	T	T	T	O	T	T	T	T
MCH	O	O	T	T	T	O	O	T	T	T
PSA	T	T	T	T	O	T	T	T	T	O
ROR	T	T	T	T	O	T	T	T	T	O
SHU	T	T	T	T	O	O	T	T	T	T
SJM	T	T	T	T	O	T	T	T	T	O
TBL	T	T	T	T	O	T	T	T	T	O
SGO	T	O	O	O	T	T	O	O	O	T
KPE	T	T	O	T	T	T	T	O	T	T
	5	3	4	4	13	7	3	4	5	13

In this two-week timetable ("O" means Out), I can see that both Fridays are going to be much more difficult than any other day so, when starting to schedule a timetable (I like to do Year 10, 11 and the Sixth Form as one exercise), I would fill the days in this order

1. *1Fri, 2Fri*
2. *1Mon, 2Mon*
3. *1Thur, 2Thur*

4. *1Wed, 2Wed*
5. *1Tues, 2Tues*

By leaving the Tuesdays until last, I know that I will have the biggest pool of available teachers at the end. In addition, by pairing the days, I have the added advantage that I can keep an eye on the weekly distribution of activities too!

Scheduling – Final Stages

Once I have completed the upper school timetable and started on the lower school blocks, it is time to start counting the gaps in finer detail so that I can try to avoid being left with certain periods, which I cannot fill with the remaining blocks.

The diagram below shows the remaining gaps which must be filled by my last Year 8 and Year 7 linear blocks:

*Notice that, in scheduling the Year 8 and 7 blocks so far, I have attempted to **zigzag** blocks in the same year. For example, looking at the first day, when 8m has a gap, 8n doesn't, when 7n has a gap, 7m doesn't. This is difficult to achieve perfectly as you can see in the case of Year 7, Monday Period 3!*

As well as the zigzagging, I have tried to keep the total number of gaps in each time slot as even as possible:

- *Monday = 2, 2, 1, 2, 2*
- *Tuesday = 1, 2, 1, 2, 2*
- *Wednesday = 1, 1, 1, 3, 2*
- *Thursday = 2, 1, 2, 1, 2*
- *Friday = 2, 2, 2, 1, 1*

Looking at these numbers, it is easy to decide which period may be the most difficult to fill. Wednesday Period 4 has three gaps, which will require three teams of teachers taken from the same subjects, teaching all at the same time! I would definitely give this lesson my attention first, as, if I cannot fill it with the teacher teams available, I will be attempting the impossible!

Zigzagging

When scheduling the initial blocks for a year group, try to keep in mind that the ideal pattern is a zigzag.

The idea is simple but it is not always possible to achieve fully. In the above example, there are five lessons where the whole year group is scheduled for an activity of some sort (Tuesday Period 5, Wednesday Period 2 etc). This isn't a problem except for the fact that:

Thursday Period 3 has nothing scheduled at all!

This means that I am going to be attempting to fill Period 3 Thursday, 8m and 8n using TEACHERS FROM THE SAME SUBJECT AREA POOL. In this particular example, it will require 8 teachers (4 in each half year group) who are:

- *All free on Thursday Period 3 and*
- *Come from Art, Music, Drama, History, Geography, PSHE or RE*

At this point, I would seek to find a way to plug this hole with one of the doubled already scheduled periods. For example, if I could move Thursday Period 4 to Period 3 for either 8m or 8n, I would be creating two easier periods but ridding myself of one very difficult period.

Gap Distribution

As you approach the final lessons of your timetable, the last blocks are going to have to fill the remaining gaps. If certain periods have lots of gaps, you are likely to reach a point where it is impossible to complete your timetable (a dead-end).

Remember: when scheduling, the easiest period is not always the best – sometimes it is worth doing some extra work to fill a potentially troublesome gap.

Always keep a count of the total gaps left to fill for each period of the timetable. Neglect periods with large numbers of gaps AT YOUR PERIL.

As with all advice concerning timetable construction and scheduling:

Always deal with the difficult before the easy because otherwise the difficult will soon become the impossible. PLUG THOSE GAPS!

About the Author

Paul Vant worked for 35 years in secondary school as a Maths teacher, Senior Teacher, Timetabler and Systems Manager. He has acted as a consultant to many schools in timetabling and assessment. He designs software and web applications to solve problems relating to all his fields of expertise. In 2000 he designed the Student Sorting Kit (used for creating balanced groups of students, now in use in secondary schools throughout the UK and in other international institutions.)