Analysing timetable clashes : the Conflict Matrix

Scenario

Timetabling is the 'art of the possible' based on the skill of compromise.
Detecting possible areas of compromise in order to achieve a working operational timetable is essential for timetablers, and an insight into the processes is also useful for those people - such as heads of department and course directors - who provide the Timetabler with specific requests.

This activity uses a well-known technique called the '**Conflict Matrix**' (ie. a clash table) to analyse the clashes caused by teacher-teams.
If this is done before the actual scheduling stage of the timetable, it allows the Timetabler to identify some possible problems. If heads of department and other managers are familiar with the technique then it can be used as the basis for informed discussions to rationalise the teacher-teams.
The Conflict Matrix is a useful supplement to the main pre-timetabling check of the Combing Chart (see the previous activities in this series).

TimeTabler 4 for Windows will produce & print out a Conflict Matrix for you.

Further reading: Chapter 6 in Keith Johnson, Timetabling (published by Stanley Thornes Ltd, ISBN 0-7487-1077-9). More details are given at **www.timetabler.com**

In-service Training Activities for your Staff

If you are the school or college Timetabler, you will find it helpful to give your colleagues (particularly the Heads of Department) the short in-service training session described here. It can be done in less than half an hour. (The Combing Chart is better to use as a first session.)

It gives your colleagues some insight into the problems of timetabling, and thereafter you will generally find it much easier to have discussions with your colleagues if you are negotiating with them to change some aspect of the timetable data.

These in-service training materials may be freely copied for use in schools & colleges provided the © copyright notice is kept on each sheet.

Activity

Introduction by you, the Tutor, using the Briefing (T1) with Factsheet (S1), followed by Course Members' activity (S2, working individually or in pairs).
They apply the technique to some sample data provided, and then discuss the implications.
Time = 20 minutes.
If the Tutor provides some real school data or prepares a completed matrix using real data (eg. using the ***TimeTabler*** program), this gives an opportunity for more focussed discussions.

Materials Checklist:

For the Tutor: OHP and transparencies of S1, S2. Sheet T1
(optional): Computer with ***TimeTabler*** loaded

For Members: Sheets S1, S2.

Tutor Briefing T1

The Tutor will need to prepare by reading the sheets (S1, S2) and then working though the activity-task.

Introduction

The Tutor should set the scene by referring to the school or college timetable, and the large amounts of data that are built into it.
The multitude of requests made by departments or individual members of staff may well be incompatible - ie. it may be mathematically impossible to timetable all of them into the normal school week because of the way they interact and clash.
Refer to the value of pre-timetable checks, and emphasise the advantage of being able to pin-point the sources of potential clashes, so that discussions can take place with the Timetabler. If you have previously used the Combing Chart activities then refer to them here.
Time = 5 minutes.

Give out the Factsheet S1 and go through it (preferably using an OHP transparency of the sheet so that you can point to the relevant sections).
Discuss it, and emphasise the impossibility illustrated in the second matrix.
If you have drawn up a Conflict Matrix using real data for your school or college, it would be helpful to show it here (but reserve discussion on it until later). Time = 5 minutes.

Activity 1

Give out Activity Sheet S2 and set the scene using the first paragraph.
An OHP and a transparency of this sheet (S2) is very useful at this stage.
Ask the students to complete the rest of the grid (preferably individually) and then tackle the questions below it (perhaps in pairs). After 4-5 minutes, show an OHP of S2 with the answers marked on the grid so that the students know that they are on the right track.

After another 4-5 minutes, discuss each answer in turn, emphasising that this matrix represents only a small fraction of a real timetable.

(*Answers:* **1.** Y11-team-4; Y10-team-2. **2.** Impossible to timetable. **3.** Y10-team-4. **4.** Impossible again; KK, because fewest clashes in that cell)

Activity 2 (optional)

You may wish to provide real data for your school at this stage (either for them to tackle on a blank matrix, or show a matrix already completed by you, for discussion).
Either way it is best to aim for a matrix showing many clashes eg. Y10 against Y11 (or Y10-upper-band against Y11-upper-band).

Visit the web-site at **www.timetabler.com**
if you want in-service training materials on other aspects of timetabling,
or if you want to download **free** timetabling software.

Factsheet: **S1**

The Conflict Matrix

The art of timetabling consists of being able to resolve a number of conflicting demands. These conflicts often arise because of the composition of the teacher-teams, particularly within option blocks.

For the Timetabler, and therefore for the quality of the timetable as it affects every member of staff, it is important to be able to pin-point potential difficulties early. Discussions between the Timetabler and the departments that are affected may then be used to reduce the conflicts, with the likelihood of a better timetable for all.
Potential conflicts can be identified by using a '**Conflict Matrix**' or clash table.

Suppose for example that one teacher-team in the Year 11 (Fifth Year) consists of two teachers, with initials AA and BB.
A second teacher-team, also in Year 11, consists of teachers CC, DD, and EE.
Meanwhile in Year 10 (Fourth Year) there is one teacher-team of AA and CC, and another team of CC, EE, FF.
By drawing a simple Conflict Matrix, we can see where the clashes occur:

		Year 11	
		Team 1 AA, BB	Team 2 CC, DD, EE
Year 10	Team 1 AA, CC	**AA**	**CC**
	Team 2 CC, EE, FF		**CC, EE**

This shows at a glance that, of these teams, only Year-11-team-1 and Year-10-team-2 could be timetabled at the same time - all the others clash because a teacher cannot be expected to teach two classes at the same time !

Even the apparent freedom of a clear cell may be illusory - for example, if one team required double periods and the other required single periods, or if both teams required the one and only Drama Studio (or another unique resource).

A point worth noting is that two clashes (as in the bottom right cell of this matrix) are no worse than one clash - both represent impossibilities. By negotiating with heads of department it is often possible for the Timetabler to clear some cells of the matrix, and so improve the situation, by deliberately creating multiple clashes elsewhere.

As a further example, the next sheet shows a matrix summarising the clashes of all the teams in Year 11 against all the teams in Year 10.

continued . . .

Year 11	Year 10 1	2	3	4	5	6	7	8	9
1	X	X			X	X			X
2		X	X			X	X		
3	X	X			X	X			X
4	X		X	X		X			
5		X			X	X		X	
6		X	X			X		X	
7	X			X		X	X	X	
8				X		X	X		X
9		X			X	X			X

In this Conflict Matrix each X shows a clash.

It is clear that Y10-team-6 cannot be timetabled at all -- it clashes against every Y11 team.

Other teams are tight, especially as the effects of different period-styles (doubles, singles, etc) have yet to be reckoned with.
If two teams need the same unique resource (eg. a drama studio, or a computer room) then this will add further clashes to the grid.

Obvious difficulties like these should always be resolved (by negotiation) before the Timetabler begins the actual scheduling of the timetable.

Further reading: chapter 6 of *Timetabling* by Keith Johnson (published by Stanley Thornes Ltd, ISBN 0-7487-1077-9).

For more details about timetabling, and free software, visit the web-site at:
www.timetabler.com

Activity 1 **S2**

The Conflict Matrix

In Laura Norder High School, the teacher-teams for Year 10 and Year 11 are as shown on the diagram:

Year 11

Year 10		AA, BB, CC 1	DD, EE, FF 2	GG, HH, JJ 3	KK, LL, MM 4	NN, OO, PP 5
AA, CC, KK	1	**AA, CC**			**KK**	
AA, PP, TT	2					
DD, LL, MM	3					
GG, LL, NN	4					
EE, MM, TT	5					

[S]

[D]

The first row of the matrix has been completed. Please complete the remainder. Assume that the diagram shows all the teams in these two year-groups.

Q1. Which team will be hardest to timetable ?
If that team were scheduled to Monday period 1, which other team would have to be scheduled to Monday period 1 ?

Q2. Suppose now that Y11-team-4 requires a double period and Y10-team-2 must have single periods. What is the situation now ?

Q3. Discussions between the Timetabler and the Head of Faculty now reveal that teacher LL in Y10-team-4 and teacher TT in Y10-team-5 can be interchanged with no disadvantage to the pupils. How does this improve the situation ?
Which team would you now timetable at the same time as Y11-team-4 ?

Q4. Now suppose also that teachers MM and TT always need the Drama Studio (or some other unique resource, eg. computer room, minibus, interactive video).
What is the situation now ?
Which teacher would you consider first of all, with a view to negotiating his/her removal or exchange ?

