



Introducing Blocking

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25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	35	20	Ga ₅	5
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	35	20	Ga ₅	5
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	35	20	Ga ₅	5
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25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ Ml ₂ Mu ₂ Ps ₁ Sc ₃	25	20	Ga ₅	5	25	It ₂ Ma ₈	10
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ Ml ₂ Mu ₂ Ps ₁ Sc ₃	25	20	Ga ₅	5	25	It ₂ Ma ₈	10
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ Ml ₂ Mu ₂ Ps ₁ Sc ₃	25	20	Ga ₅	5	25	It ₂ Ma ₈	10
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ Ml ₂ Mu ₂ Ps ₁ Sc ₃	25	20	Ga ₅	5	25	It ₂ Ma ₈	10
			20	Ga ₅	5			

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* Tutor Groups 13		* Games 5		* Maths-It 10		* Humanities 4		* English 8						
25	Ar ₃ Dr ₁ Fm ₁ Ml ₂ Mu ₂ Ps ₁ Sc ₃	13		20	Ga ₅	5		25	Ge ₂ Hi ₂	4		20	En ₈	8
25	Ar ₃ Dr ₁ Fm ₁ Ml ₂ Mu ₂ Ps ₁ Sc ₃	13		20	Ga ₅	5		25	Ge ₂ Hi ₂	4		20	En ₈	8
25	Ar ₃ Dr ₁ Fm ₁ Ml ₂ Mu ₂ Ps ₁ Sc ₃	13		20	Ga ₅	5		25	Ge ₂ Hi ₂	4		20	En ₈	8
25	Ar ₃ Dr ₁ Fm ₁ Ml ₂ Mu ₂ Ps ₁ Sc ₃	13		20	Ga ₅	5		25	Ge ₂ Hi ₂	4		20	En ₈	8
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25	Fm ₁ Ml ₂ Ps ₁ Sc ₃	7		20	Ga ₅	5		25	Ge ₂ Hi ₂	4		25	Ar ₃	3	25	Dr ₃	3
25	Fm ₁ Ml ₂ Ps ₁ Sc ₃	7		20	Ga ₅	5		25	Ge ₂ Hi ₂	4		25	Dr ₃	3	25	Mu ₃	3
25	Fm ₁ Ml ₂ Ps ₁ Sc ₃	7		20	Ga ₅	5		25	Ge ₂ Hi ₂	4		25	Mu ₃	3	25	Mu ₃	3
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Idea

Starting with the simplest curriculum model (that of a Junior school in which all lessons are taught in tutor groups) I will gradually introduce you to using blocks to enable you to group your students in varying ways to satisfy the needs of the subjects being studied.

Blocks can be used to create groups of students which are:

- Of mixed ability
- Vertically set
- Streamed
- Banded

They are also used to allow students an element of choice (options)

The following examples will hopefully demonstrate that, In timetabling, there are two types of flexibility factors, which mirror each other in behaviour:

- Scheduling flexibility (ease of scheduling, lots of possibilities and choices)
- Student grouping flexibility (ability to group students differently according to the subject requirements)

As scheduling flexibility increases, grouping flexibility decreases. As grouping flexibility increases, scheduling flexibility decreases.

I will be using curriculum models taken from Sims Nova-T6

Model 1

*	Tutor Groups	40
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ga ₅ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	40
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ga ₅ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	40
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ga ₅ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	40
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ga ₅ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	40

Interpretation

This is how one could show a curriculum model for 4 groups of students, 25 in each class, to be scheduled for 40 periods over the timetable cycle with each activity being allocated the number of lessons shown after each two-letter subject code.

For example, here we see that each group has: 3 lessons of Art (Ar); 1 lesson of Drama (Dr); 8 lessons of English (En) etc with the subjects listed alphabetically.

It is important to realise that, when you schedule these lessons with teaching staff in a particular time slot, each of the four groups may well be doing different subjects especially if you want each subject taught by a specialist teacher rather than simply a form tutor.

	Monday 1	Monday 2	Monday 3	Monday 4	Monday 5	Monday 6	Monday 7	Monday 8
Group 1	Ge (AHI)	Sc (JBU)	MI (JNA)	Mu (SSP)	Hi (KLA)	Ar (JBU)	En (CBC)	Ma (PVA)
Group 2	Ma (PVA)	Hi (KLA)	Ga (SNL)	Ar (JBU)	Ma (PSV)	En (CBC)	Ps (MMK)	Ge (AHI)
Group 3	Sc (GDU)	Dr (JVP)	It (MPL)	Ma (PSV)	Ps (MMK)	Ma (PSV)	Ge (AHI)	Hi (KLA)
Group 4	Ar (JBU)	En (CBC)	Fm (JCH)	Hi (KLA)	It (MPL)	Dr (JVP)	Ma (PVA)	Dr (JVP)

Scheduling

Looking at a possible schedule for Mondays (see above where the two-letter subject is followed by the three letter teacher code), you can see that, in this model, each group remains together as a group throughout every day of the week and in every subject.

*This simple system, known as a **linear block**, contains classes known as **Pure** classes. It is a very easy system to schedule as you have a large number of choices of teachers (and subjects) when scheduling each lesson. The only restriction you have is that you cannot use the same teacher twice in any one time period.*

Unfortunately, this sort of scheduling flexibility means that there is no student grouping flexibility - the students remain in the same group for the whole week!

Model 2

*	Tutor Groups	35	*	Games	5
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	35	20	Ga ₅	5
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	35	20	Ga ₅	5
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	35	20	Ga ₅	5
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ It ₂ Ma ₈ Ml ₂ Mu ₂ Ps ₁ Sc ₃	35	20	Ga ₅	5
			20	Ga ₅	5

Interpretation

The school has now decided that it wants all the students to do Games at the same time with sufficient teachers to reduce group sizes to 20. The phrase "at the same time" is what determines how subjects are blocked.

In order to achieve this aim, we move the Ga (Games) lessons from the large linear block to a block dedicated only to Ga. We create five groups in this block.

We now have two blocks, one linear block which is slightly less flexible to schedule (because it has had the Games teachers removed) and one very inflexible block (because we have to schedule all five Games teachers at exactly the same time, five times!)

By changing the grouping arrangements for 5 lessons out of 40, we have reduced the flexibility (the choices) we have when we start pinning lessons to time slots.

	Monday 1	Monday 2	Monday 3	Monday 4	Monday 5	Monday 6	Monday 7	Monday 8
Group 1	Ge (AHI)	Sc (JBU)	Ga (PGW)	Mu (SSP)	Hi (KLA)	Ar (JBU)	En (CBC)	Ma (PVA)
Group 2	Ma (PVA)	Hi (KLA)	Ga (SNL)	Ar (JBU)	Ma (PSV)	En (CBC)	Ps (MMK)	Ge (AHI)
Group 3	Sc (GDU)	Dr (JVP)	Ga (BBO)	Ma (PSV)	Ps (MMK)	Ma (PSV)	Ge (AHI)	Hi (KLA)
Group 4	Ar (JBU)	En (CBC)	Ga (GFT)	Hi (KLA)	It (MPL)	Dr (JVP)	Ma (PVA)	Dr (JVP)
			Ga (AVF)					

Scheduling

*Now look at Monday's schedule (above). On Monday Lesson 3, we can divide the 100 students into 5 classes and everyone will be doing Games together. The Games teachers can change these groups any time throughout the year and it will have no effect on the groupings for the other subjects. In fact, Games groups could now be **sets** (determined by ability) if desired.*

The other subjects (in the linear block) can be scheduled much like before but there will be no Games teachers to add to your choices when deciding what goes when!

Note that by scheduling this entire team of Games teachers on Monday lesson 3, you have probably made it impossible to schedule any Games at all for any other year groups at that time! We have gained grouping flexibility and lost scheduling flexibility!

Model 3

*	Tutor Groups	25	*	Games	5	*	Maths-It	10
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ Ml ₂ Mu ₂ Ps ₁ Sc ₃	25	20	Ga ₅	5	25	It ₂ Ma ₈	10
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ Ml ₂ Mu ₂ Ps ₁ Sc ₃	25	20	Ga ₅	5	25	It ₂ Ma ₈	10
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ Ml ₂ Mu ₂ Ps ₁ Sc ₃	25	20	Ga ₅	5	25	It ₂ Ma ₈	10
25	Ar ₃ Dr ₁ En ₈ Fm ₁ Ge ₂ Hi ₂ Ml ₂ Mu ₂ Ps ₁ Sc ₃	25	20	Ga ₅	5	25	It ₂ Ma ₈	10

Interpretation

Now that IT has recently morphed into Computing and Programming, the school has decided to embrace this by having students taught the subject by Maths teachers and the students grouped according to ability.

By placing IT and Maths in one block, we allow for this new grouping arrangement with the knowledge that we must now schedule 10 lessons where the Maths/IT teachers are teaching together as a team **in the same time slots**

By making this change we have:

- Decreased further the flexibility of the linear block (Maths and IT can no longer be chosen)
- Added an extra inflexible block where four teachers have to be scheduled as one team, at the same time, ten times!

	Monday 1	Monday 2	Monday 3	Monday 4	Monday 5	Monday 6	Monday 7	Monday 8
Group 1	Ge (AHI)	Sc (JBU)	Ga (PGW)	Mu (SSP)	It (PVA)	Ar (JBU)	En (CBC)	Ma (PVA)
Group 2	Ps (PVA)	Hi (KLA)	Ga (SNL)	Ar (JBU)	Ma (PSV)	En (CBC)	Ps (MMK)	It (QSV)
Group 3	Sc (GDU)	Dr (JVP)	Ga (BBO)	En (CSI)	It (TSV)	Hi (KLA)	Ge (AHI)	Ma (PQS)
Group 4	Ar (JBU)	En (CBC)	Ga (GFT)	Hi (KLA)	Ma (JYT)	Dr (JVP)	Hi (KLA)	It (JYT)
			Ga (AVF)					

Scheduling

We now have three different grouping arrangements. Monday 3 has the students doing Games together in groups of 20. Monday 5 and Monday 8 have the students set by ability and doing either Maths or IT with the same teacher or two different teachers.

Remember that this arrangement means that the top set in Maths will be the same class as the top set in IT and so on down to the bottom set. If you wanted

to break this connection, IT would have to be removed from this block and placed in another.

Again, after adding a new grouping arrangement, our scheduling flexibility has been reduced and it is now going to be more difficult (if not impossible) to schedule Maths, IT or Games for any other year groups at the times they occur on Mondays.

Model 4

*	Tutor Groups	13	*	Games	5	*	Maths-IT	10	*	Humanities	4	*	English	8
25	Ar ₃ Dr ₁ Fm ₁ Ml ₂ Mu ₂ Ps ₁ Sc ₃	13	20	Ga ₅	5	25	It ₂ Ma ₈	10	25	Ge ₂ Hi ₂	4	20	En ₈	8
25	Ar ₃ Dr ₁ Fm ₁ Ml ₂ Mu ₂ Ps ₁ Sc ₃	13	20	Ga ₅	5	25	It ₂ Ma ₈	10	25	Ge ₂ Hi ₂	4	20	En ₈	8
25	Ar ₃ Dr ₁ Fm ₁ Ml ₂ Mu ₂ Ps ₁ Sc ₃	13	20	Ga ₅	5	25	It ₂ Ma ₈	10	25	Ge ₂ Hi ₂	4	20	En ₈	8
25	Ar ₃ Dr ₁ Fm ₁ Ml ₂ Mu ₂ Ps ₁ Sc ₃	13	20	Ga ₅	5	25	It ₂ Ma ₈	10	25	Ge ₂ Hi ₂	4	20	En ₈	8
			20	Ga ₅	5							20	En ₈	8

Interpretation

This is starting to look more like a Year 8 secondary school model. Before you read further, you might like to look at the scheme above and decide for yourself what the school might want to achieve using this model.

- Ar, Dr, FM, MI, Mu, Ps and Sc remain as pure mixed ability groups
- Games is scheduled at the same time for all students divided into five groups
- Maths and IT are taught together in 4 classes set by ability
- Geography and History are **streamed** (there are two equal top sets and two equal bottom sets). This means, when this block is scheduled, it is scheduled as a team of four teachers from Geography OR History
- English has mixed ability teaching in the first four classes but the fifth class is a withdrawal class to enable students who have specific needs to be taught in a much smaller group. All five English teachers must be scheduled at exactly the same time and so, together with the Games block, it is likely to be the hardest to schedule and, once scheduled, to be the cause of difficulties scheduling in other year groups

	Monday 1	Monday 2	Monday 3	Monday 4	Monday 5	Monday 6	Monday 7	Monday 8
Group 1	Ar (AHI)	Sc (JBU)	Ga (PGW)	Mu (SSP)	It (PVA)	En (PUT)	Hi (KHL)	Ma (PVA)
Group 2	Sc (PVA)	MI (KLA)	Ga (SNL)	Ar (JBU)	Ma (PSV)	En (CBC)	Ge (MMK)	It (QSV)
Group 3	Sc (GDU)	Dr (JVP)	Ga (BBO)	Ps (CSI)	It (TSV)	En (HKY)	Ge (AHI)	Ma (PQS)
Group 4	Ps (JBU)	Mu (CBC)	Ga (GFT)	MI (KLA)	Ma (JYT)	En (JVT)	Hi (KLA)	It (JYT)
			Ga (AVF)			En (UYT)		

Scheduling

Everything is starting to look more blocky!

Notice that the original linear block is starting to look increasingly like the other blocks. In particular, Monday 1 now has two Science teachers teaching at the same time as the subjects in this block are gradually being crunched together.

In order to avoid making the school timetable impossible to schedule, timetablers will often come up with a logical plan for gradually introducing more complicated grouping as the students progress through the school. For example, my most recent school timetable had the following properties:

- Year 7 – 5 blocks
- Year 8 – 6 blocks
- Year 9 – 8 blocks

Then, from Year 10 upwards, we introduce an element of choice (options)

- Year 10 – 8 blocks (4 core and 4 option)
- Year 11 – 8 blocks (4 core and 4 option)

Then, for the Sixth Form, we allow students a complete choice

- Year 12 – 5 option blocks
- Year 13 – 5 option blocks

Option Blocks

* Tutor Groups 7		* Games 5		* Maths-It 10		* Humanities 4		* English 8		A Option A 3		B Option B 3	
25	Fm ₁ Ml ₂ Ps ₁ Sc ₃	20	Ga ₅	25	It ₂ Ma ₈	25	Ge ₂ Hi ₂	20	En ₈	25	Ar ₃	25	Ar ₃
25	Fm ₁ Ml ₂ Ps ₁ Sc ₃	20	Ga ₅	25	It ₂ Ma ₈	25	Ge ₂ Hi ₂	20	En ₈	25	Ar ₃	25	Dr ₃
25	Fm ₁ Ml ₂ Ps ₁ Sc ₃	20	Ga ₅	25	It ₂ Ma ₈	25	Ge ₂ Hi ₂	20	En ₈	25	Dr ₃	25	MU ₃
25	Fm ₁ Ml ₂ Ps ₁ Sc ₃	20	Ga ₅	25	It ₂ Ma ₈	25	Ge ₂ Hi ₂	20	En ₈	25	MU ₃	25	MU ₃
		20	Ga ₅					20	En ₈				

Interpretation

Here I have added an element of choice for the students. They can choose two subjects (one from Option A and one from Option B). Assuming they are not allowed to double up subjects, these are the possible combinations:

- Art and Drama
- Art and Music
- Drama and Music

Remember that this adds two more blocks in which you have to schedule a team of teachers from different subject areas at the same times. Not only that but how do I

know how many classes of each subject to add to the blocks. This latter point is the essence of option block construction – you have to ask the students to choose before you create the blocks OR you have to restrict the choices of some students to fill the classes you have added!

Whatever method you employ to determine the classes offered within an option block, you will find that you can't usually keep everyone happy!

The art of creating and optimising option blocks will be dealt with in a future article

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.)