Appendix 1 – Dual Objectives Board: Explaining Science and Classification

Primary Science Assessment Board

	Knowledge & Understanding		Working Scientifically		
	Explaining Science	Classification	Designing Experiments	Data, Tables & Graphs	Making Conclusions

	EYFS → KS1 → Secure			LKS2 → Secure		UKS2 → Secure →		
	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 6+
Explaining Science	I remember simple facts about science with help	I remember some simple facts about science	I remember relevant science **facts** with some confidence	I use science ideas & facts to describe & explain	I show a developing K&U of science ideas & **concepts**	I show a clear K&U of science ideas & concepts	I show a **secure** K&U across all KS2 topics (facts & concepts)	I show a deeper 'mastery' of K&U across KS2
	I use science words during an activity with help	I use & remember relevant science words during activity	I use & **remember** science words over time (short term)	I remember science words I have used before (longer term)	I **use** simple science words correctly (meaning; apply)	I begin to use complex science words correctly	I use **complex** science words correctly (**fluency**)	I use complex science words accurately & fluently
	I describe what is happening using words & actions	I describe what is happening using science with help	I use **science** to describe / **recall** what I have seen	I begin to use science models to describe (sequence)	I use **science models** to **describe** (what, where)	I use science models to describe & begin to explain (why, how)	I use **science models** to describe & **explain** (why, how, logical)	I begin to apply science models to explain new events
	I use appropriate pictures & words to label items	I add science word labels (help) to diagrams	I **add science labels** & information (help) to diagrams	I add science labels & information to diagrams	I **annotate** diagrams to help describe & explain	I begin to draw & annotate my own diagrams	I draw & annotate my **own diagrams** to describe & explain	I draw & annotate my own diagrams (flow; complex)
	I begin to select facts to use in an answer with help	I select science facts to use in an answer with help	I **select** relevant science facts to use in an answer	I link relevant facts together in an answer	I '**cluster**' related facts together into points (recalled)	I select & prioritise facts to create an argument/answer	I present a **clear & logical** argument / answer	I present an extended & logical argument / answer
Classification	I sort using instructions or pictures	I sort by using simple yes/no statements	I **use** simple spider keys with **obvious differences**	I use large sider keys with obvious differences	I **use** a range of spider keys with **fine differences**	I construct spider & use number keys	I **construct** both spider & number keys	I construct both spider & number keys (complex)
	I group by familiar features (size, colour, shape, etc)	I group by difference or similarity	I **group** by difference, similarity or change	I create groups for sorting (create criteria)	I **create** appropriate groups for sorting (create criteria)	I group & sub-group by easily observation (create criteria)	I group & **sub-group** by fine observation (create criteria)	I group & re-group using combinations of criteria
	I use my senses to identify properties of materials	I link properties of materials to an application (help)	I **link properties** of materials to an application	I combine properties required for an application (help)	I **describe combined properties** required for an application	I explain how properties suit an application	I **explain the science** behind a range of properties	I describe how material properties can change

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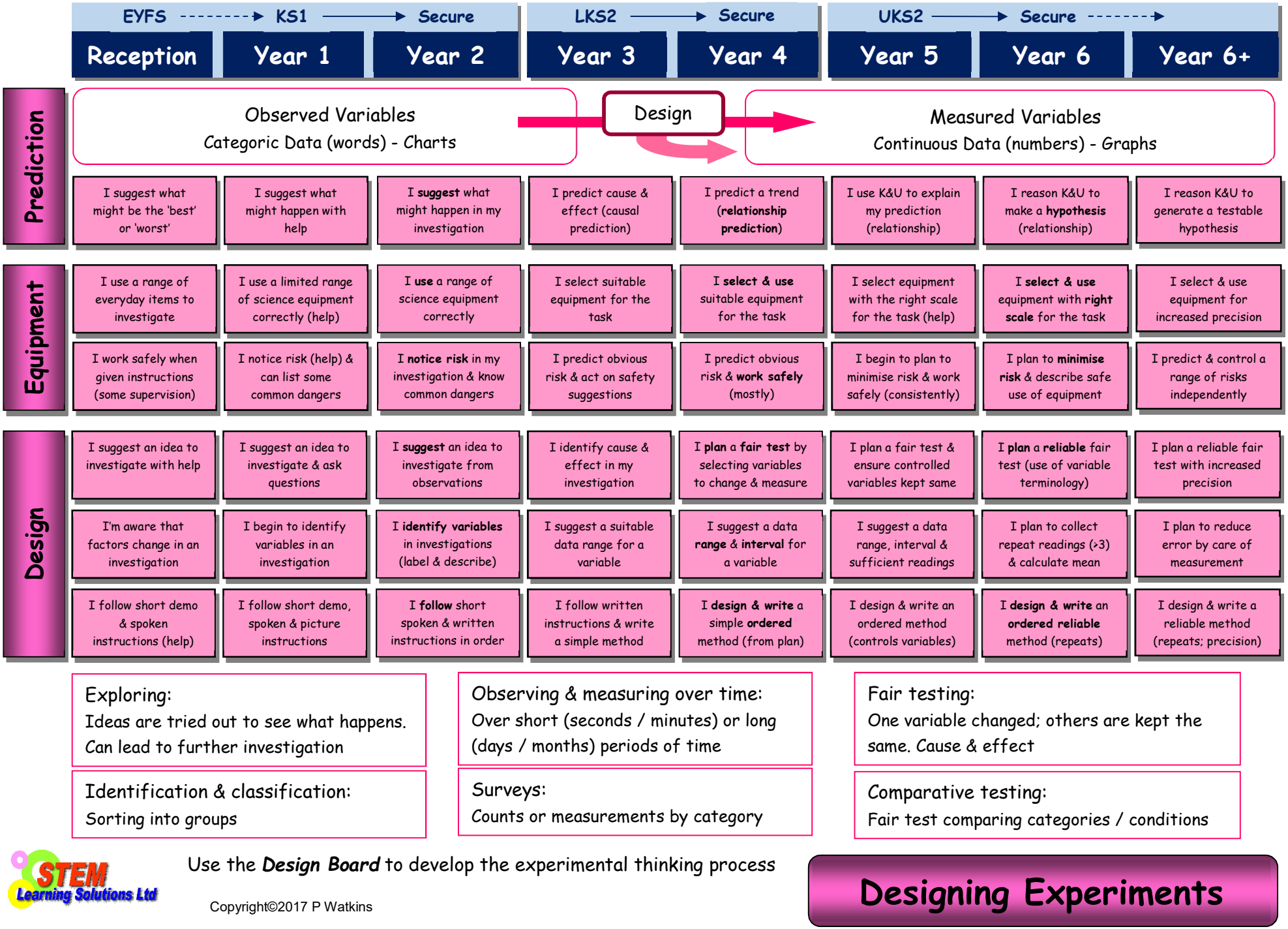
Explaining Science

Classification

Appendix 2 – Dual Objectives Board: Designing Experiments



Exploring:
Ideas are tried out to see what happens. Can lead to further investigation

Identification & classification:
Sorting into groups

Observing & measuring over time:
Over short (seconds / minutes) or long (days / months) periods of time

Surveys:
Counts or measurements by category

Fair testing:
One variable changed; others are kept the same. Cause & effect

Comparative testing:
Fair test comparing categories / conditions

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Use the ***Design Board*** to develop the experimental thinking process

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Designing Experiments

Appendix 3 – Dual Objectives Board: Making Conclusions

	EYFS → KS1 → Secure			LKS2 → Secure		UKS2 → Secure →		
	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 6+
Patterns	I recognise, create & describe simple patterns (e.g. size)	I recognise, create & describe simple number patterns	I **describe** simple features & **patterns** in data & charts	I describe simple patterns in data, charts & graphs	I **describe** simple patterns, **trends** & relationships in data	I describe patterns, trends & relationships in data	I **describe changing patterns**, trends & relationships	I compare changing patterns, trends & relationships
	I begin to use 'more or less', etc to compare observation	I use 'more or less' to compare numbers	I see obvious **differences in sets of numbers**	I see subtle differences in sets of numbers	I see **differences (error) in repeated data**	I spot anomalous data that doesn't fit the pattern	I **spot anomalous data** & explain from the method	I deal with anomalous data to increase reliability
Conclusions	I talk about changes that I observe during activities	I describe the changes that are happening	I **describe the changes** that have happened	I describe my results by linking cause & effect	I **describe trends** & begin to use science to **explain**	I use data in my conclusions & use science to explain	I **use 1°/2° data** & science ideas in my **conclusions**	I use a range of data in conclusions & models to explain
	I explore 'what if ..' questions through play	I explore different ways to do things through play	I suggest a **different way** to do things with help	I suggest improvements to my method	I suggest **sensible improvements** to my method	I identify strengths & weaknesses & improvements	I suggest **limitations (data) & practical improvements**	I suggest limitations (use data) & justify improvements

Working Scientifically – word lists

KS1

Axis = reference line drawn on a graph to show the range of data for each variable (shows values)
Block chart = visual toll to show data/counts as bars built up by adding component blocks. Used to compare data visually
Cause = the variable we chose to change in an investigation
Data = a measured or counted outcome for a variable (numbers)
Effect = the variable that changes when we change the cause
Experiment = investigation that looks for a link between variables (fair or comparative test)
Observation = sensed outcome for a variable (described in words)
Pictogram = chart that uses pictures to represent data
Prediction = suggests what might happen based upon prior knowledge or experience (not a guess)
Results table = way of presenting data from an investigation
Risk = dangers when doing an investigation, using equipment or working in an area
Standard units = a quantity of a variable that is used as a standard measure (e.g. litre, meter, gram, etc)
Variable = a factor that can change

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LKS2 (plus KS1)

Bar chart/graph = visual tool that uses bars to compare discrete data
Comparative test = fair test comparing discrete differences
Conclusion = the answer you give to a question (based upon data)
Continuous data = values are numbers (result from counting/measuring)
Coordinate = used to plot data (x/y) on a graph
Data interval =numerical gap between data points for a variable
Data point = a coordinate for a variable
Data range = maximum & minimum values for a variable
Discrete data = values are distinct/separate (e.g. male/female; counts)
Fair test = an investigation where only one variable is changed (cause); all others are kept the same and at their best value
Line graph = visual tool that shows a relationship trend between two continuous variables (it is essentially a scatter graph)
Method = ordered sequence of steps taken during an investigation. It can be written or in diagram form
Prediction (correlation/relationship) = describes the expected trend for two variables (cause & effect) that are linked
Prediction (scientific/causal) = suggestion as to what might happen based upon prior knowledge, experience or observation. Links the cause with the predicted effect. Does not have to describe the trend
Spider key = branching classification key where each branch has a yes/no choice (dichotomous key) leading to further choices
Trend = the outcome when two variables (cause & effect) are linked

UKS2 (plus KS1/LKS2)

Anomalous data = data that does not fit a pattern
Controlled variable = variables kept at the same value so they do not influence the dependent variable in a fair test

Making Conclusions

Data set = vales for repeated data
Data spread = variation of the data away from a mean (often due to imprecise measuring or when the controlled variable have not been kept the same)
Dependent variable = changed (effect) as a result of changing another. This is observed or measured and demonstrates a relationship in a fair test
Hypothesis = a reasoned prediction based upon theory, experience or direct observation
Independent variable = chosen variable (cause) changed in a fair test.
Mean = 'average' value from a data set
Number key = classification key that is a written, condensed version of a spider key
Precision = how similar your repeated data is (good technique & equipment choice)
Primary data = your experimental data or observations from an investigation
Reliability = if your data can be repeated (i.e. no error). Can be improved through collecting repeated values and calculating a mean
Results table (complex) = Table that contains multiple columns to show repeated data, calculations or a variety of features of a variable
Risk assessment = formal assessment of risk leading to improved safety recommendations or change in practice
Secondary data = researched data or observations. It can also be data gathered from others doing a similar experiment. Used to compare/support
Trend line = line drawn roughly between coordinates to show the trend (does not have to go through all data points)
Valid data = reliable, accurate & no bias or error (we are measuring what is expected)

Appendix 4 – Dual Objectives Board: Data, Tables & Graphs

EYFS ⇢ KS1 → Secure | LKS2 → Secure | UKS2 → Secure ⇢

	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 6+
Data	I can position numbers on a number track up to 20	I can position numbers on a number track up to 100	I measure **labelled** divisions on a number line (inc. in steps)	I measure unlabelled divisions on a number line (+ve values)	I measure **unmarked** divisions on a number line (+ve values)	I measure divisions on a number line past zero (-ve values)	I **scale up/down** a number line (axis) & decide on limits	I scale up/down a number line (axis) confidently
	I use non-standard units to measure & compare	I measure in non-standard & compare e.g. heavier/lighter	I measure **standard units** (inc. length, mass, capacity)	I measure/compare values in standard units	I **measure/convert** values in standard units (inc. time)	I measure/convert values in standard units (inc. area)	I **measure/calculate** with standard units (inc. area & volume)	I calculate compound units (e.g. acceleration)
Tables	I use a simple table by recording in pictures & words	I use a simple table by recording in words and numbers	I **use** a simple table recording in words & numbers (inc. tally)	I use a frame to construct a simple table of results	I **construct** a **simple table** to compare cause & effect	I use a frame to construct a complex table of results	I **construct** a **complex table** to show repeated data	I construct complex tables to include calculations
Graphs	I use prepared pictograms to record my observations	I use a frame to add to pictograms & block charts	I **construct** simple pictograms & **block charts**	I use a frame to construct a bar chart (help)	I **construct bar charts** correctly (inc. numerical axis)	I use a frame to construct a graph & can scale axes (help)	I **construct graphs** & can scale at least one axis independently	I construct graphs & can scale each axis confidently
	I add to pictograms by counting up	I add to block charts by counting up	I **use the scale** on a block chart to add the correct blocks	I draw bars on a bar chart (one axis coordinate)	I **plot coordinates** on a graph in the first quadrant	I join plotted coordinates with straight lines	I plot mean values & draw a **trend line** for linear data	I plot mean values & draw a trend line for non-linear data

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Data, Tables & Graphs