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Learning Tasks*

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Joanne Lobato: "Guided Development"

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Abstract

A comparison of 16 learning tasks from Australia, Germany, Hong Kong, Japan, Shanghai and United States is made under the themes: using daily-life context, the connected nature in a sequence of tasks and making the mathematical process visible. Despite the very different cultural origin, we see some shared values in pedagogies such as using daily-life context, interactive class atmosphere and strategies in making use of students' contributions. In the theme about the connected nature between learning tasks, we differentiate two different ways in making connections, namely, from implicit to explicit and vice versa. Finally, we observe different ways of making mathematical process visible in the examples.

What is a "learning task" lesson event?

Every lesson has an object of learning which is often explained in the teacher's goals for the lesson. Such an object of learning usually is either a mathematical concept or skill which the teacher wants the students to learn in the lesson. Teachers use tasks, which may be either their own design or taken from textbooks, to illustrate or explain the concepts or skills. When students are engaged in these tasks either in whole class discussion led by the teacher, individually, or in groups, depending on the teacher's class arrangement, the event constituted by the interaction between the task and the discourse between the teacher and students or between the students is hereby called a "learning task" lesson event.

The next question will be what is counted and what is not counted as a learning task. I will clarify this with an example. In learning mathematics, teachers sometimes ask students to do some practice item of a repetitive nature. For example, a problem such as "to solve $x+y=4$ and $x-y=5$" appears very often in the mathematics lessons in Hong Kong, probably in other parts of the world too. A common occurrence is for the teacher to do a "worked example" on the blackboard. The students then are asked to do a set of problems that strongly resemble the worked example. The first worked example which a tool to teach the students something new, will be called a "learning task" where as the subsequent problems subsequently attempted by the students are not. In other words, a learning task aims to teach the students something new and is different from a practice item for the repetition of a taught skill.

Learning tasks may serve more than one purpose. For example, in the case of Shanghai, teachers used learning tasks mostly in a whole class context for purposes such as:

1. Setting a background for the topic to be further developed.
2. Demonstration or explanation - often with visual display and interactive question-and-answers between the teacher and the students.
3. In-depth investigation/discussion of a specific aspect of the object of learning.

Furthermore, the connected nature of learning tasks is also an important characteristic. Therefore, sometimes tracing a sequence of learning tasks in one lesson or consecutive lessons help to see how the object of learning is being explicated to the class.

The data and the approach in the comparison

The data discussed in this paper consisted of sixteen learning tasks, one from Germany and three from each of the following: Australia, Hong Kong, Japan, Shanghai and United States. These lesson events are chosen by the researchers from their home data according to the aforementioned definition. The comparison aims to seek for an understanding of the nature of teaching mathematics and the possibilities of how the students may be brought into an awareness of an object of learning.

The basic assumption is that differences and similarities will be more visible when learning tasks in different culture are compared with each other. The analysis applies the grounded theory approach. The video and the transcripts were read several times for open coding. The open coding stage ended when common themes emerged for the next level of comparison. Learning tasks which carries the same theme are grouped and read through again to look for further differences and similarities between tasks.

The results

Using daily-life context - AU3-L6 and SH3-L01-1

AU3-L6

In AU3-L6, the teacher's aim for this lesson is to introduce the students to 'rounding off'. She uses a humorous approach to introduce the problem, which appeals to the students and gains their interest. The problem involves a night out at a restaurant and having to split a bill of $67 dollars between three. She writes the problem on the board and asks for suggestions of how much each person will have to pay if the bill is divided equally. Several students offer answers, some have used their calculators and give numbers which contain many decimal places, others do a rough calculation in their head and offer responses. The teacher writes up a suggestion offered from two girls that each person should pay $33.33, she then asks a boy how much he would pay and he suggests $33.34. The teacher asks him why he would do this and he explains. The teacher then relates this problem to decimal places and highlights the importance of rounding off.

SH3-L01-1

In SH3-L01-1, the teacher asks the class to solve mentally a word problem which is translated below:

> *Xiu-min and his family went to Beijing for a holiday. They booked 3 adult tickets and 1 student tickets, costing a total of 560 dolllars. His classmate Xiu-wang learning this decided to join Xiu-ming's family for the trip. Consequently, they bought 3 adult tickets and 2 student tickets, costing a total of 640 dollars. Please calculate the cost of 1 adult ticket and the cost of 1 student ticket.*

The teacher invites the students to answer the question and explained the method. Two students (Dora and Eva) gave the answer with an arithmetic method. Then, the teacher asked the student to represent the problem in terms of two equations $3x+y=560$ and $3x+2y=640$. Referring to the students' earlier answers, the teacher explained that the arithmetic method was equivalent to subtracting one equation from the other.

The Australian and the Shanghai learning tasks share many similarities. First, the teachers in both cases use a daily-life context to introduce the topic of the day. Besides giving a background for the topic of the day, the tasks also serve as an example for the subsequent concept or skill to be taught in the lesson. Both teachers invite their students to suggest their own methods and strategies and both result in interactive classroom atmosphere. They are similar in the fact that the students' answers are likely to be within the teachers' expectations. In both cases, the teacher is very clear that there is an object of learning she or he wants the students to learn. In the Australian lesson, it is the concept of rounding off whereas in the Shanghai class it is the concept of linear equations in two unknown.

Comparing the transcripts carefully, there is an important similarity which contributes to explicate the objects of learning. Both teachers ask a question to guide the students to focus on one of the students' suggestions.

AU3-L6

```
T: [Writing on the board] OK. You did sixty-seven divided by three …
on your calculator. OK. Everybody get that … do that sum and get it
up on your screen, please.
…
T: What have you got on your screen?
…
T:[writing on board] Twenty-two point three, three, three, three,
three, does it?
```

SH3-L01-1

```
T: Since we've learned about equations before, this question can be
solved by using equations...let's think about the unknowns before the
equations are set? So what do you think of the question? How to set
the unknown? How many unknowns?
…[The teacher asked the students to give the equations.]
T: OK so let's see, Dora has just said that the price for each
student ticket is six hundred and forty minus five hundred and sixty
actually...six hundred and forty minus five hundred and sixty is
equivalent to deducting the two equations we've just set.
```

After getting more than one suggestions from the class, the Australian teacher asks everyone to refer to the answers in the calculators, by doing this the rounding off of 22.33333 to 22.33 is differentiated from the various answers suggested earlier. The Shanghai teacher asks the students to do the same problem with equations and pointed out that the equations are alternative representations of their earlier arithmetic method. By such action of revisiting the scene, the object of learning is introduced.

The connected nature in a sequence of tasks –SH3 and US2

A mathematics object is a very complex feature. On the one hand, it can be precisely defined in a few lines. On the other hand, it is rich in characteristics and relationship demonstrating its multifaceted nature. An understanding of the concepts can only be developed via different experiences of the object. The learner's understanding of the object is dynamic. That is, during each interaction with the mathematics, the learner may experiences something new and try to make sense of it to build a coherent picture of the object. In this way, the learner's understanding grows. The different kinds of experiences and their connected nature presented to the learners are extremely crucial in this process. The Shanghai and US data, which are on the same topic for the same class by the same teacher, give an opportunity to explore the connected nature in a sequence of learning tasks.

SH3-L01-1 and SH3-L01-2

The sequence of learning tasks are taken from the Shanghai data which happens in the same lesson. According to the teacher questionnaire, the goals of the lesson are: "To understand linear equations in two unknowns and their solutions; and the concept of solution sets. Find the parts of solutions that satisfied some certain conditions of the linear equations in two unknowns solution set. To build the basis for understanding linear equations in two unknowns and the concerned concepts; and linear equations in multiple unknowns and the concerned concepts." The lesson has many objectives which are fulfilled by many tasks. Two learning tasks both about the concepts of linear equations in two unknowns are chosen here to illustrate the connected nature between tasks. They are hereafter called SH3-L01-1 and SH3-L01-2. SH3-L01-1, which is described earlier in this paper, is a word problem about buying tickets. By asking the students to solve the problem with different strategies, the teacher contrasts the student's arithmetic method of solving the problem and the equation method which he refers to as different representations of the same method. By doing this, he also demonstrates an example of linear equations in two unknowns for which the teacher concludes by saying the definition of linear equations in two unknowns and showing a visual display of the definition with powerpoint. The teacher carries on the lesson by guiding the students to solve a pair of equations before he begins the next learning task SH3-L01-2 which is translated below:

> *To determine which of the following is a linear equation of two unknown.*
>
> *1.* $2x+3=0$ *2.* $x+2y-1=0$ *3.* $1/2\,x=2/3\,y+1$
>
> *4.* $2x+5y=z$ *5.* $x^2+2y=1$ *6.* $2xy=5$

US2-L02 and US2-L04-1

On teacher questionaires, the US teacher stated that her goal for the learning task in US2-L02 was for students "to see the interrelationships among equations, their graphs, tables and verbal descriptions." On the questionnaire for L04, the teacher articulated a related goal: "I wanted students to begin to see that the 'equation' form of an algebraic relationship is more than a meaningless composition of number and letters. In fact, the equation could be 'translated' completely into a picture in the mind."

The sequence begins at the end of Lesson US2-L02. The class works on the "Algebraic Meaning for Representations" problem. For the learning task, students (arranged in small groups of four) are given 2 worksheets which are cut out into 40 cards. Each card contained one of the following: (a) an algebraic equation; (b) a graph; (c) a verbal statement; or (d) a table. The cards represented 10 linear and non-linear functions. The students were supposed to sort the cards according to the function that was represented. The equations for the10 functions were as follows: $y = x^2$; $y^2 = x$; $2y = x$; $y = x - 2$; $y = 2x$; $y = x + 2$; $x + y = 2$; $xy = 2$; $y = 2$; and $x = 2$. The teacher lets students work on the learning task in groups of four. The target group uses this time to get organized and oriented to the task although it is possible that Breanna (one of the target students) solves one of the problems. The teacher stops the students and creates a sub-task, namely to find the verbal description, graph, and table for the algebraic equation $x = 2$. She lets students work on this problem for 4 minutes in their small groups. Then she demonstrates the solution by calling on students to share their solutions. The discussion of the sub-task is short but the teacher brings out two ideas: (a) when $x = 2$, y can take on any value; and (b) the graph of the equation "*x* equal to some number," is a vertical line.

Rather than conducting an in-depth and open-ended discussion of this learning task, the teacher poses a new learning task in Lesson L04 (calling US2-L04-1) as a way of pulling together the ideas from the Algebraic Meaning for Representations task. US2-L04-1 begins with a new warm-up problem, but during the latter part of lesson, students return to the Algebraic Meaning for Representations task. They work in groups to prepare a presentation of part of the problem. During Lesson L04, the groups post their presentation "posters" and each group checks their responses to the activity.

After all the "posters" of the ten solutions to the Algebraic Meaning of Representations task had been displayed and after students had checked their answers against the displays, the teacher discussed the findings by posing a new learning task. She posed the following five related questions and asked students to write their responses in their notebooks and on whiteboards:

1. What do these graphs have in common? (Teacher points to the graphs of $y = x + 2$, $2y = x$, $y = 2x$, $y = x – 2$, and $x + y = 2$.)

2. Is the graph of an equation like $x=2$ vertical or horizontal?

3. $y=2x$ is a model of direct variation because it a) crosses through the origin b) passes through quadrant I.

4. Is the slope of this graph (points to the graph of $y = x – 2$) positive or negative?

5. This point [teacher points to the point (0,2) on the graph of $y = x + 2$], (0,2), is the *x* intercept or the *y* intercept?

When comparing the Shanghai and US learning tasks, we see both similarities and differences.

In terms of learning objectives, both teachers see their tasks oriented towards one object of learning: the meaning of linear equations in two unknown for Shanghai and algebraic meaning for representations for US.

In both cases, the teachers make use of alternative representations in the first learning tasks. In Shanghai, the problem is represented in written text as well as equations; the method of solution is represented in terms of a student' s description of arithmetic method as well as the equation method. These alternative representations are subtle and not explicit until the teacher mentions them openly. In US, the application of alternative representations is very explicit in the students' hands-on activity. The students are asked to sort out alternative representations of the same equation. However, the tasks are concluded in very different ways. In Shanghai, the event lasts for about 5 minutes and is ended by teacher's definition of the concept. In US, the whole task is only completed after the students have completed their homework and posted up their posters in the lesson after next.

SH3-L01-1

T: we call this kind of equations the linear equations in two unknowns. Linear equation in two unknowns; if they consist of two unknowns and the power of each unknown is one, we call this kind of equations linear equations in two unknowns.

US2-L04-1

T: Algebraic- no let's call it this, Ideas about Algebraic representations, let's put it that way. Ideas about Algebraic Representations. Okay?

T: And we're going to look at those four areas again what are they?

T: One of them is?

Ss: Graph.

Teacher: Graph, another is?

Ss: T-chart.

T: T-chart, another is?

Ss: Equations.

T: And the fourth is?

Ss: Verbal expressions.

T: Alright, alright so we're talking, we're going to talk about ideas related to those four types of representations in one way or the another.

The two learning tasks are connected differently in the nature of their design and the classroom discourse. In Shanghai, the second task appears to be an independent exercise. It is connected to the first task because the students have to apply what they have just learned in the first task. The connection is implicit in the design of the lesson and such connection only becomes explicit in the interaction between the teacher and the students.

SH3-L01-2

T: The first, two x plus three equals zero...Elsa.

Elsa: It is not. Because it has only one unknown, it is not...it is not linear equations in two unknowns.

T: Good, it is not. There is only one unknown right?

T: The first is not linear equations in two unknowns. So what about the second one?

E: It is.

T: Yes, say together, why?

E: It has two unknowns and the unknowns are of power one.

…

T: How about the sixth? ...Two x y equals five.

T: Students sharing the same desk discuss among yourselves, do you think the sixth one belongs to the system? [E discussing among themselves] [Teacher walking around]

…

T: Does it belong to the system and for what reason?...Okay, let us justify whether it belongs to the system or not, if you think it is, please raise your hands. [Some students raising their hands]

T: Okay. Anyone thinks it is not? We let those who disagree to explain. Why is it not?

Franc: It is because two x y, x y is an unknown.

T: x y is an unknown? [Students laughing]

T: Students laughed, is x y an unknown?

E: x y are two unknowns.

T: If you use this method to justify, of course your justification is wrong, right? What else? Freda.

Freda: The power of each unknown should be one, while two x y is an unit, the power of it is two.

T: The power of this single unit is two, so it is not. Does everyone agree?

E: Agree.

In US, the second task is explicitly connected to the first task because it makes use of the product of the first task. The five new questions refer to a subset of the equations in the first task and are posed after the students' posters are posted up in the lesson. However, in the class interaction, the connection between the equations and the five questions becomes implicit. Each question may be seen as an independent question.

US2-L02

T: Okay. I'm going to point to several graphs. I'm going to ask you what they have in common. In just a moment.

T: This one. This one. This one. This one. This one. This one.

T: I need you to respond by telling me whether those graphs were linear or non-linear.

T: Write it down, write down your choice. Linear or non-linear.

…

T: It turns out that a graph like X equals two always creates a vertical line or a horizontal line? Put it down.

T: It turns out that a graph like X equal two always creates a vertical line or a horizontal line.

T: //Alright. Third question.

…

T: This graph is a model of direct variation because it, choice, lies in the first quadrant, lies in quadrant one, crosses quadrant one or passes through the origin. Passes through zero, zero.

T: This graph models direct variation because it, crosses quadrant one or passes through the origin, zero, zero?

Making the mathematical process visible - G1-L05, HK2-L02, JP3-L3 and SH3-L01-3

There are many algebra problems. One from each of Germany, Hong Kong, Japan and Shanghai will be described and compared.

G1-L05

The teacher has introduced "the three" binomial formulas (the variables used are *a* and *b*). The students work on a worksheet containing tasks such as: $(2e + 3f)^2 =$

The tasks in the worksheet are of increasing complexity. The teacher did not show how to apply the formulas. Therefore, the students have to figure out the method themselves. During this period, the teacher does "Between-Desk(s)-Walking". **Alexandra** and **Bettina** are the focus students. They are engaged in non- public talk when solving the task.

Alexandra: What have you got?

Bettina: Four.

Bettina: I`ll write that.

Alexandra: You`ve forgotten that it`s squared.

Bettina: Oh yeah.

HK2-L01

The teacher demonstrates how to solve a pair of simultaneous equations (x+y=4, x-y=5) by the method of substitution. The teacher explains as he carries out the computation step by step on the board. The teacher does most of the talking except that he occasionally invites students to suggest an answer for the next step.

T: Move two y here... move five here. What's the answer?

The students are attentive in general answers but their answers are mostly inaudible and needed to be repeated by the teacher again.

JP3-L3

The teacher asks the students to check the solution of the simultaneous equations 3x+2y=23 and 5x+2y=29. The work is an assignment of the last day. Some students try to complete the work in their own notebook. The teacher invites two students

(Uchi and Kizu) to present their different methods on the board. During this period, the teacher does “between-desks-walking” to check the students’ work. After the two students have finished. The teacher asks the class to compare the two students’ work.

T: Umm, in this classroom right now out of the many ways that I saw of checking this calculation, I asked to have the two typical ways written on the blackboard but,

T: do you understand how the one UCHI wrote and the one KIZU wrote differs? First, I want you to notice their differences.

T: Do you see the differences? Who understands?

T: Ok, I see. Ok, well, you can discuss this with your neighbor but what and where are these two answers different, have the people who've written this noticed? Do you understand the differences?

T: You may be able to explain the things you wrote but it might actually be difficult to explain what other people wrote. Please jot down some differences.

T: Um, you can discuss this like always, so, I will give you about three minutes. All right? You understand what to do, right?

T: I want you to point out the differences between these two ways of checking the equation. That's what I want you to be doing.

T: Ok, well, get going. You can discuss. Go ahead. Like usual. Please discuss.

<u>SH3-L01-3</u>

This event is a demonstration of how to rewrite an equation in a specific format (to change the form x+2y=10 by writing x in terms of y and y in terms of x). The teacher begin by explaining why they want to do this. He asks a student Dora to suggest a way. Dora gives a wrong answer “y=10-2x” orally. The teacher asks Dora to elaborate how she gets the answer and she has difficulty. Another two students Denny and Eliza are invited to give their suggestions to complete the work.

T: To start with we use the substitution equation of x to represent y. [E thinking]

T: Dora.

Dora: y equals ten minus two x.

T: y equals ten minus two x right? So would you briefly explain the process...I'll write it down for you. [Teacher writing on the board]

Dora: Moving the terms.

T: Moving the terms?

Dora: y equals ten minus two x.

T: How do you move the terms? Are you just trying to say something?

T: Don't be nervous? Moving two y, not x?

Dora: Moving two x.

T: Moving two x. Where is two x? [Dora shaking her head]

T: Can you find out? Can't you find out? Okay, you can't find out. We move on to the one you can find out, at the side.

Denny: Two y equals ten minus x.

T: Two y equals ten minus x.

Denny: y equals brackets ten minus x over two.

T: y equals brackets ten minus x over two, right? Okay, sit down...the second question use the substitution equation of y to represent x.

T: Eliza.

`Eliza: Moving x equals ten minus two y.`

In learning algebra, students are often taught how to carry out some standard procedures of computation with symbols. When students are doing these symbolic computations, the thinking in their heads is usually invisible. However, the four aforementioned learning tasks show the possibility of sharing students' thinking at different visibility level by different teaching strategies. In the German example, the potential for learning is embedded in the design with problems with increasing complexity. When the students try to figure out the answer, they develop their understanding. Therefore, the process of thinking inside the students' mind is crucial. However, their thinking will not be visible until they share their ideas with others, e.g., the sharing between Alexandra and Bettina.

Comparing the Hong Kong and German examples, the Hong Kong example represents another extreme. Whilst the German example only has the students' work, the Hong Kong teacher emphasizes a correct demonstration of the process which given by himself. Consequently, the clarity and the content in the teacher's exposition and the students' attentiveness are crucial.

The Shanghai example falls in between the German and Hong Kong cases. The Shanghai teacher asks a student Dora to elaborate her work for her wrong answer and invites two other students Denny and Eliza to participate. Therefore, the task is in some sense completed jointly by Dora, Denny, Eliza and the teacher with an effort of making the process visible to the whole class.

The Japanese example belongs to another kind. The focus of the Japanese example is not on the process how the students produce their work. Instead the focus is on looking back on what they have produced. Consequently, the invitation by the teacher to comment the two students' work initiates discussion till the end of the lesson, the content of which includes ideas such as the meaning of a solution for equations and the presentation of checking which lead to another level of understanding of the process.

Discussion

The purpose of comparison is based on a very simple assumption that there will be similarities and differences when lessons in different countries are contrasted. Some features become very visible in comparison across different culture.

The comparison of the learning tasks is carried out under three themes: using daily-life context, the connected nature in a sequence of tasks and making the mathematical process visible. In the two examples of using daily-life context, we see remarkable similar features between Australia and Shanghai. Despite the very different cultural origin, we see some shared values in pedagogies such as using daily-life context, interactive class atmosphere and strategies in making use of students' contributions. In the second theme about the connected nature, we differentiate two different ways in making connections, namely, from implicit to explicit and vice versa. Readers must interpret the observation with caution. The small number of tasks in this paper can only describe connection to a very limited extent. The connection observed by the researcher may only represent only a small corner of the complete map in the teacher's mind. Furthermore, the connection made in the students' mind may be a very different picture. However, the connection between concepts and tasks are important because it suggests a potential for helping students to make sense of their learning and construct a coherent piece. Comparison in the final theme leads to an awareness of the different ways of making the process of doing mathematics visible in a lesson. It shows different possible emphases even in teaching contents of a similar nature, e.g. on student work, on teacher's demonstration, on the sharing of ideas, on the mathematical process and on evaluation of work. Very little conclusion can be drawn from the four examples at this stage. However, the variation leads to the next agenda: Should the variation be a consequence of individual teacher's preference, the students' preference, a choice of pedagogical beliefs or a difference in culture? What is the rationale for these choices? What will be the resulting lesson of these choices?

The findings in this paper based on the analysis of a small subset of the LPS data carry neither the implication that one example is better than the other nor that some features can be casually claimed to be a national characteristic. Nevertheless, the contrast brings about a better understanding of the nature of mathematics teaching per se and possible variation in different cultures.

Appendix: A list of the sixteen learning tasks

AU3-L6	16:59 - 24:07	The problem involves a night out at a restaurant and having to split a bill of $67 dollars between three.
AU4-L11	05:22 –20:36	Some rules for finding angles (vertically opposite angles, alternate angles, corresponding angles, co-interior angles) in F, U C, X and Z shapes.
AU4-L12	13:07 –16:58	To fit a number of triangles into this shape.
G1-L05	23:43 - 26:41	A worksheet containing tasks such as: (2e + 3f)2 =
HK2-L01	09:37 - 16:18	Solve a pair of simultaneous equations (x+y=4, x-y=5)
HK2-L02	06:04 - 11:08	Solve: $\begin{cases} y - x = 3 \\ 2x + y = 24 \end{cases}$
HK3-L05	11:43 - 19:46	Draw the graph of the linear equation in two unknowns y = 2x + 3 Where x takes values from –2 to 2.
JP1-L01	01:48 - 05:00	(Step problem) Asking students to draw the figure of the fourth and fifth steps and to think about what is changing as the step becomes larger. 
JP1-L04	01:18 - 06:20	(Origami problem) The teacher takes out origami paper and folds it, asking the students to think about “what changes when we change the location of the folds.”
JP3-L3	03:30 - 14:24	Checking the solution of the simultaneous equations 3x+2y=23 and 5x+2y=29.
SH3-L01-1	00:00 - 05:00	Wong Junior goes to the post office to buy several two-dollar and one-dollar stamps, at least one of each kind, costing a total of ten dollars. How many of each kind of stamps does he get?
SH3-L01-2	05:30 - 09:28	To determine which of the following is a linear equation of two unknown. 1. 2x+3=0 2. x+2y-1=0 3. 1/2 x=2/3 y+1 4. 2x+5y=z 5. x2+2y=1 6. 2xy=5
SH3-L01-3	20:14 - 23:26	Change the form x+2y=10 by writing x in terms of y and y in terms of x.
US2-L02	25:22 - 36:44	Algebraic Meaning for Representations The students were supposed to sort the cards according to the function that was

		represented. The equations for the10 functions were as follows: y = x2; y2 = x; 2y = x ; y = x - 2; y = 2x; y = x + 2; x + y = 2; xy = 2; y = 2; and x = 2. Each card contained one of the following: (a) an algebraic equation; (b) a graph; (c) a verbal statement; or (d) a table.
US2-L04	14:58 - 38:56	Discussion of the Algebraic Meaning of Representations task via a new learning task of 5 related questions. 1. What do these graphs have in common? (Teacher points to the graphs of y = x + 2, 2y = x, y = 2x, y = x – 2, and x + y = 2.) 2. Is the graph of an equation like x=2 vertical or horizontal? 3. y=2x is a model of direct variation because it a) crosses through the origin b) passes through quadrant I. 4. Is the slope of this graph (points to the graph of y = x – 2) positive or negative? 5. This point [teacher points to the point (0,2) on the graph of y = x + 2], (0,2), is the x intercept or the y intercept?
US2-L04	38:56 - 51:32	Continuation of the discussion via a second learning task of 5 related questions. 1. Rename x+y = 2 in terms of y. 2. What is the slope of y=-x + 2? 3. Are these graphs (teacher points to the graphs of xy = 2, y = x2, y2 = x) linear or non-linear? 4. What does non-linear mean? 5. Squaring results in what kind of shape?