Conceptualisation of Misunderstanding and Understanding –
a phenomenographic study of students’ conceptions of allocative efficiency in Economics

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Abstract

It is not uncommon for lecturer to assume student understanding key concepts in her/his organisation and presentation of a topic, when these concepts, in fact, can be quite problematic for the students. This creates barriers to knowledge development in students. To overcome this barrier, it is important that we obtain students’ knowledge prior to and following instructions to inform teaching. A number of studies (Voss et al, 1986, Pong, 1999, Marton, 1988) have found that the student might have learnt a concept and utilised it in one context, but were not capable of transferring it for use in another, most notably in the context of everyday life. This raises two related questions: (1) When a student is taught an economic concept but chooses not to use it to make sense of an economic phenomenon, what is it about the economic concept that they have learnt (or mis-learnt)? (2) If the student possesses misunderstanding, how is it acquired?

The paper reports on the preliminary findings of a study conducted at an Australian university, exploring the various ways commencing economics students understand the concept of allocative efficiency. In this study, written responses taken from 90 exam scripts to a structured final exam question are subject to rigorous phenomenographic analysis (Marton, 1981). Six conceptions of allocative efficiency are identified, and insights into these qualitatively different, commonly shared perceptions of this fundamental economic concept, which emerge from students’ written responses, allow us to better understand how they develop various misconceptions. The paper also discusses the implications of these findings and argues for a relational perspective of effective teaching.

I Introduction

In a study comparing the use of analytical skills and economics knowledge in the solving of economic problems, Voss et al (Voss, Blais, Greene, & Ahwesh, 1986) found that students with formal training in introductory economics (the novice) and those without (the naïve), demonstrated similar economics knowledge and informal reasoning skills. The novice performed better than the naïve only on questions involving the use of technical knowledge. In the case of non-technical economic issues that provided opportunities for the novice to demonstrate economic knowledge acquired in formal training, no such knowledge transfer took place, and their answers were not qualitatively superior to the naïve. Similar phenomena have been observed in research into economics education at secondary levels (see Dahlgren, 1979, quoted in Pong 1999) and in other disciplines, most notably on understanding of concepts in physical sciences (Marton, 1983). The implication is that students might have amassed enough economics knowledge in a subject to pass examinations but their teachers are not equipping them with the economic way of thinking and the ability to interpret real world phenomena. This kind of learning amounts to a quantitative change (more knowledge) but the qualitative impact on the student’s outlook is very limited.
If we accept learning is a process of developing new ways of conceptualising reality, then how teaching can bring about conceptual development in students must be the highest priority. Drawing on the work of Chinn and Brewer, and Gunstone, Pong (Pong, 1999) argues for a shift in perspective in the study of the process of conceptual development. Instead of seeing learning as a conceptual change, it is more fruitful to look at it from a multiple conception perspective, in that learning a new concept is not a simply process of replacing an old understanding with a new one. In short, during the process of learning, the student can possess multiple conceptions of a concept and choose to move between them in different contexts. This multiple conception perspective logically implies a second order perspective (i.e. perception of a phenomenon from the perceiver’s perspective). In educational context, it is equivalent to saying that what is learnt and how learning occurs should be seen not from the perspective of the teacher but that of the learner. Descriptions and explanation of learning is therefore predicated not on what teachers think, but on possibilities, i.e. the possible ways the learners perceive and understand the phenomenon. This offers insights into why and how mislearning occurs, and it informs the teachers as to how they might overcome barriers to conceptual development.

In this study the aim is to find out how commencing students in economics understand the fundamental concept of allocative efficiency. It focuses on two aspects of their learning outcomes: (1) the meaning they have extracted (the referential aspect), and (2) how they relate the various aspects of the concept to the meaning they arrive at (the structural aspect) (Marton, 1988).

II Data Collection

Introductory economics is offered at Queensland University of Technology (QUT) as two units (Economics 1 and 2\(^1\)). The course is organised in such a way that both microeconomics and macroeconomics are taught in Economics 1, and dealt with in greater depth in Economics 2. In this study, we analysed the examination scripts of 90 students sitting for the Economics 2 final examination in semester 2 1999. The raw data (their written answers) were taken from the first 90 examination scripts in the alphabetical order of students’ surnames, which effectively constitute a randomly selected sample.

The examination paper contains three sections – 30 multiple choice questions (30%), 2 structured short answer question (40%) and 1 essay question (30%). The question of interest in this study is one of the two structured questions (see appendix 1), based on a competitive poultry market, that has been taken over by a single firm. In part (b), the students are asked to explain if the equilibrium output in the competitive market also represents the allocatively efficient output. This is followed by parts (c) and (d), which focus on the impact of the takeover on the equilibrium price and output, and consumer and producer surpluses in the monopolised market. Then, in part (e), the students are required to explain whether or not equilibrium and allocative efficiency are the same or different concepts, based on their answers in previous parts.

The raw data are students’ written answers to parts (b) and (e). Students’ answers in part (c) and (d) were not used in the analysis, the only exceptions being when they are needed for clarification of the answer in part (e). (This occurred in only a few cases.)

\(^1\) QUT is the fourth largest university in Australia with more than 30,000 students. Around 1000 students take Economics 1 each semester, and about half this number go on to do Economics 2.
III Method of Analysis

The raw data was read several times to uncover similarities and differences in students’ conceptualisation of allocative efficiency. The outcome of this recursive process was the emergence of a number of non-overlapping categories, which constitute the space of students’ conceptions of the concept, and which represented the different critical aspects of the concept being focused on. This was followed by a second stage of categorisation, where the categories were taken back to the raw data and classified according to the categories. This classification was carried out independently by two researchers. Their results were then compared, and differences of opinions discussed in detail. As a result, of all the statements considered, a total of 126 statements were identically categorised by the two researchers (an agreement rate of 88%). The validity of the six categories is essentially based upon a sense of completeness in the understanding of students’ perceptions of the phenomenon and is demonstrated in part by the extent of inter-rater agreement\(^2\).

IV Results

Allocative efficiency is one of several key aspects pertaining to the theory of resource allocation. (The concept map depicting these aspects and their inter-relations is given in Appendix 2.) Other key aspects include equilibrium (value maximisation) of consumer and producer, market equilibrium, allocative efficiency, distribution of the social surplus between producers and consumers, the long and short run, and minimisation of average cost of production. They can be used to compare and contrast different forms of markets, with perfect competition and monopoly being the ‘ideal types’ at either end of the continuum.

A The Six Student Conceptions of Allocative Efficiency

Category 1 A Consumer Perspective

This is not a fully expressed conception. In the written statements, fragments of this conception appear in students’ answers, where consumer welfare is focused upon and taken as equivalent to social welfare. That is, a loss in consumer welfare means to a loss in social welfare. According to this conception, a market is efficient when consumer welfare is maximised. In other words, allocative efficiency is not achieved if consumer welfare is reduced.

Examples:

‘Equilibrium in (a) refers to the maximum amount of output available for that given market price. It is therefore not the same as being allocatively efficient as to be allocatively efficient, there would be a balance between the demand and supply for poultry that would see the maximisation of utility.\(^3\)’ (SA)

\(^2\) It must be pointed out that when analysing and interpreting the scripts, the researchers tried as far as possible to ‘blank out’ their pre-conceptions about the possible interpretations of the concept. The six conceptions identified in this study were not obtained from any theoretical model, rather they emerged from the raw data. The schematic representation in appendix 2 was developed after completion of data analysis and data classification.

\(^3\) Italics in students’ written statements denote the authors’ emphasis.
‘… Allocative efficiency … does happen in a PC [perfectly competitive] market. The equilibrium … also indicates efficiency. Consumers are getting a max surplus at \( Q_e \) [equilibrium output]. …’ (AJC)

**Category 2  A Profit Perspective**

This conception has its focus on the profit of firm. If the firm can utilise its resources ‘efficiently’, then it can maximise its profit. And the firm is said to have achieved allocative efficiency.

Examples:

‘Because the firm controls the market, equilibrium and allocative efficiency are different. Even though profits might be made when MR=MC there is still the dead weight loss, and the producers aren’t maximising profits.’ (AB1)

‘… Allocative efficiency refers to whether any resources are wasted and can be moved into other areas to make a greater profit. … As in the case of the monopolist poultry farmer, all the available resources were being maximised and could not have been used more efficiently elsewhere to make a greater profit. …’ (AB2)

It is also interesting to note here that despite both holding a profit perspective, the two students above come to opposite conclusions. AB2 argues that in monopoly the firm is efficient because it maximises its profit by restricting output and charging a higher price, while AB1 argues that since deadweight loss exists in monopoly, the firm has not yet maximised its profit and therefore is not efficient. Here AB1 misinterprets deadweight loss and relates it to a firm’s profit. In fact, other students have different interpretations of the concept of deadweight loss, which will be discussed in a later section.

**Category 3  A Cost Perspective**

This is a commonly held conception. The focus is still on the firm as in category 2, but now it is the average cost of production, and from the standpoint of the society, that is the focus. To students holding this conception, allocative efficiency is achieved if the firm can efficiently utilise (or allocate) its resources to minimise average production cost. The thinking is that allocative efficiency is socially desirable because output can be produced at the least possible cost (minimum average cost of production).

Examples:

‘No, [equilibrium and allocative efficiency are not the same] because the monopoly can be at equilibrium, yet still doesn’t achieve allocative efficiency. A monopoly can make economic profits in the long run, there they are not operating at min \( ATC \). Whereas a firm in a perfectly competitive market in the long run can only make normal profit (0 econ profit) and is operating at min \( ATC \).’ (TRC)

‘… This is in contrast with monopolies where resources are not being fully utilised. Inefficiency is between quantity and min \( ATC \). …’ (MRC)

‘No, [efficiency and allocative efficiency are] different concepts because equilibrium is where S and D is equal and allocative efficiency is where inputs are used in a
technologically efficient way to give the lowest cost, but in monopoly there is always resource wastage of some degree.’ (RSC)

**Category 4 A Distribution Perspective**

Here the focus has shifted entirely to the market. According to this conception, the market is efficient if it is equitable, which occurs when the social surplus of production is equally shared between the producers and consumers. It is a normative conceptualisation of an otherwise positive economic concept.

Examples:

‘Equilibrium and allocative efficiency are similar concepts because they both result in equal distribution of surpluses between the consumer and producer where neither side can gain any more surplus without the other side losing out.’ (JB)

‘Yes, the equilibrium [in perfect competition] is efficient as consumer surplus is equal to producer surplus. …’ (KC)

‘Yes. In a perfectly competitive industry, this is the allocatively efficient output. Producers charge the price, Pe … see at Qe [where] consumer and producer surplus is also shared equally.’ (IRD)

**Category 5 An Equilibrium Perspective**

This is another common misconception. Here a different aspect of the market is focused upon – the demand and supply. Efficiency is now conceptualised as the function of the price mechanism to clear the market, resulting in neither shortages nor surpluses.

Examples:

‘Yes, the equilibrium output is the allocative efficiency output. This is because there is not surplus and no shortage due to the demand for poultry and supply of poultry being exactly the same at the equilibrium point.’ (PRC)

‘Based on the previous answers, equilibrium and allocative efficiency are almost the same concept where total D equals to total S and the level of output is the level at which average cost is minimised. This way there is not shortage or surplus hence no one is deprived of the product and producers don’t lose out with excess inventory.’ (MD)

**Category 6 A Social Surplus Perspective**

Allocative efficiency, properly understood, is a market outcome where the net social welfare or social surplus of production is maximised. Analytically, this occurs at the output level, where marginal social cost equals marginal social benefit. At any other level of output, there is a deadweight loss. This conception, like the last two conceptions, also focuses on the relation between production and consumption. But it is a different aspect of this relation (the maximisation of social surplus) that is the focus.
Example:
‘In a perfectly competitive market equilibrium output is the allocatively efficient output. This is because in a perfectly competitive market, \( Dm = \text{Marginal Benefit} \), \( Sm = \text{Marginal Revenue} \). In this market, consumer and producer surplus is maximised and there is no deadweight loss.’ (LB)

The six conceptions identified represent the outcome space of the phenomenon discerned by the students. The focuses and meanings of these six critical aspects are summarised below (Table 1). (N is the number of occurrences of each conception that were agreed upon by the two independent judges.)

<table>
<thead>
<tr>
<th>Conception</th>
<th>Focused on</th>
<th>Meaning of concept</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Consumer welfare</td>
<td>Maximisation of consumer welfare</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Firm’s profit</td>
<td>Maximisation of firm’s profit</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Average production cost</td>
<td>Minimisation of average production cost</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>Distribution of social surplus</td>
<td>Equal distribution of social surplus of production</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Equilibrium</td>
<td>Market demand equal to market supply (no surplus and shortage)</td>
<td>29</td>
</tr>
<tr>
<td>6</td>
<td>Social surplus</td>
<td>Maximisation of social surplus of production</td>
<td>41</td>
</tr>
</tbody>
</table>

Table 1 Outcome of space of conceptions of allocative efficiency

B Multiple Conceptions

In majority of cases, students manifest a single conception of allocative efficiency. For example, TRC in both parts (b) and (e) conceptualises allocative efficiency from the cost perspective.

‘Yes, the output [in perfect competition] is also the allocatively efficient output because firms in a perfectly competitive market operate at min ATC. (Because only a normal profit can be made due to ease of entry and exit in the industry.)’
[Answer to (b)]

‘No, because the monopoly can be at equilibrium, yet still doesn’t achieve allocative efficiency. A monopoly can make economic profits in the long run, there they are not operating at min ATC. Whereas a firm in a perfect competitive market in the long run can only make normal profit (0 econ profit) and is operating at min ATC.’
[Answer to (e)]

Aside from the six conceptions, a second crucial finding of the study is the existence of multiple conceptions which was observed in the case of twenty students. These students shifted effortlessly from one conception to another in their explanation. The shift can occur
within the same answer (intra-contextual shift) or between answers to different parts of the question (inter-contextual shift) (Pong, 1999). We illustrate these conception shifts below, and discuss their implications.

**Inter-contextual shift**

In the examples below, both students focused on one critical aspect of the concept in part (b) and spontaneously shift to another in part (e). Their conceptions, those critical aspects of the concept that are focused upon and their discerned variations are tabulated in Table 2 and 3, following their written statements.

‘Yes, the equilibrium output in a perfect competitive market is the allocative efficiency output. Under competition, the market will be forced to produce at the lowest price possible (**Cost Perspective**) and at the greatest quantity of output possible for the market. [Answer to (b)]

Equilibrium and allocative efficiency are two different concepts. Equilibrium represents that amount of output and that price at which the firm can best maximise its profits. Allocative efficiency represents a situation in which benefits are equally shared by both consumers and producers (**Distribution Perspective**) and there is no net loss to society.’ (MD1) [Answer to (e)]

<table>
<thead>
<tr>
<th>Conception</th>
<th>Aspect focused on</th>
<th>Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part (b)</td>
<td>3</td>
<td>Cost of production of production</td>
</tr>
<tr>
<td>Part (e)</td>
<td>4</td>
<td>Equity</td>
</tr>
</tbody>
</table>

**Table 2**  **An example of inter-contextual shift in conception**

‘Yes. In a PC industry, this is the allocative efficiency output. Producers charge the price, Pe. They sell at Qe. Consumer and producer surplus is shared equally (**Distribution Perspective**).’ [Answer to (b)]

‘Equilibrium and allocative efficiency are definitely not the same concepts. As shown … the monopoly is in equilibrium, i.e. MR=MC. However it is not allocative efficiency, as shown by the existence of a loss of welfare as dead weight loss (**Social Surplus Perspective**).’ (IRD)[Answer to (e)]

<table>
<thead>
<tr>
<th>Conception</th>
<th>Aspect focused on</th>
<th>Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part (b)</td>
<td>4</td>
<td>Equity</td>
</tr>
<tr>
<td>Part (e)</td>
<td>6</td>
<td>Social surplus</td>
</tr>
</tbody>
</table>

**Table 3**  **An example of inter-contextual shift in conception**
Intra-contextual shift

In the following example, VC manifests the equilibrium perspective in part (b). In part (e), he changes to the social surplus perspective - inter-contextual shift, but immediately shifts to the cost perspective and finally moves back to the equilibrium perspective - intra-contextual shift. The table following summarises the shifts in the student’s conceptions.

‘Yes it is the allocative efficiency output … in this graph supply produces exactly where Demand want supply to produce. Therefore efficiency S=D and MC=MR (Equilibrium Perspective).’

[Answer to (b)]

‘The equilibrium and allocative efficiency are different concepts. Because in monopoly equilibrium, inefficiency exists (as mentioned above) due to MB > MC (Social Surplus Perspective) therefore the resources used is not employed efficiently and can be employed alternatively at a lower cost (Cost Perspective). Therefore leads to inefficiency in monopoly. It is also due to the fact that monopoly is not producing at capacity (Cost Perspective), it reduces qty produced to increase price. Therefore what is produced is below Demand (Equilibrium Perspective).’ (VC) [Answer to (e)]

<table>
<thead>
<tr>
<th></th>
<th>Conception</th>
<th>Aspects focused on</th>
<th>Variations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part (b)</td>
<td>5</td>
<td>Demand &amp; supply</td>
<td>Demand = Supply</td>
</tr>
<tr>
<td>Part (e)</td>
<td>6</td>
<td>Marginal benefit and marginal cost</td>
<td>Marginal benefit &gt; marginal cost</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Cost of production of</td>
<td>Average cost of production above minimum due to below capacity production.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Demand &amp; Supply</td>
<td>Supply is ‘below demand’.</td>
</tr>
</tbody>
</table>

Table 4     Inter- and intra-contextual shifts

C     Types of misunderstanding

This study shows that many students possess misunderstanding of the concept of allocative efficiency. Their misunderstanding can be further classified into three types:

(1) Firstly, the student focuses on the incorrect aspect and from it develop the misconception. The student is not aware of the critical aspect that define allocative efficiency.

Example:

‘Yes the equilibrium output in (a) is the allocatively efficient output. Firms operate at production capacity meaning that what is produced reached a limit where ATC=MC.'
Hence the organisation is producing efficiently and reaching equilibrium.’

[Answer to (b)]

‘Equilibrium and allocative efficiency are different concepts. The market is clearly not in equilibrium as there is no competition. Allocative efficiency is occurring as if the firm was to produce more, diseconomies would be gained wasting resources. Less production would result in less economies of scale.’ (RPB)

[Answer to (e)]

RPB focuses only on the cost of production – allocative efficiency is about whether the firm can produce at the lowest possible average cost. (‘If the firm was to produce more, diseconomies would be gained wasting resources. Less production would result in less economies of scale.’). In his explanation, he is unaware of the relation between marginal social cost and marginal social benefit, social surplus or deadweight losses.

(2) The second group of students are aware of one or more critical aspects of allocative efficiency, such as deadweight loss (DWL). However, they mis-interpret it, i.e. interpret it from a non-social surplus perspective. The various interpretations of DWL, for example, are illustrated below.

**DWL related to profit**

‘Because the [monopoly] firm controls the market, equilibrium and allocative efficiency are different. Even though profits might be made when MR=MC there is still the dead weight loss, and the producers aren’t maximising profits.’ (AB1)

AB1 discerns deadweight loss. But he sees profit as the defining aspect for allocative efficiency. From the profit perspective, DWL is interpreted as a loss to the monopolists because the producers ‘aren’t maximising profits’.

**DWL related to equilibrium**

‘The output in (a) is also the allocatively efficient output since there is no loss to society. All consumer demand has been supplied and there is no shortage or wastage of output at this quantity.’ (CC)

In this case, deadweight loss (‘loss to society’) is conceptualised as a disequilibrium phenomenon.

**DWL related to cost of production**

‘... in monopoly even though the market (the firm) is in equilibrium, allocative efficiency is not achieved. It is not achieved because of the deadweight loss ... because of the inefficient practises, an (sic) disincentive to economise.’ (HJC)

Here, DWL is linked to the ‘inefficient practises’, and ‘disincentive to economise’ of the monopolist, which results in the firm producing above the minimum average total cost.

(3) The third type of misunderstanding involves multiple conceptions. These students are able to discern the critical aspect (social surplus, or equilisation of marginal social cost and benefit) of allocative efficiency, but they fail to thematise it (Marton 1999). As a
result, to them, the two or more aspects discerned are treated as equally valid criteria for ascertaining allocative efficiency.

Example:

‘The equilibrium output is also the allocative efficiency output. In perfect competition demand is equal to marginal benefit (MB), and supply is equal to MC (marginal cost) above minimum average variable cost (AVC). Allocative efficiency is achieved where MB=MC, which does happen in a PC market (conception 6). The equilibrium output is being produced at min ATC, which also indicated efficiency (conception 3). Consumers are getting a max surplus at Qe (conception 1).’

‘Equilibrium and allocative efficiency are different concepts. Allocative efficiency can be achieved in a perfectly competitive market as output is being produced at minimum total cost (conception 3) and the price is equal to the marginal cost (conception 6). This indicates consumers aren’t paying extra than what it costs for production for their goods. In a monopolised market equilibrium doesn’t not equal allocative efficiency. Price doesn’t not equal marginal cost (conception 6), thus consumers are paying more (conception 1), output is not produced at minimum cost (conception 3) and there is a society net loss (conception 6).’ (AJC)

Note that AJC is simultaneously aware of at least three aspects of the resource allocation process: consumer welfare, average production cost and social surplus. He accurately describes the variations within each aspect as a result of the takeover, by pointing out that the monopolisation of the market has led to a reduction in consumer welfare, an increase in average cost of production and a net loss to society. However, AJC fails to thematise and focus on the critical aspect of variation central to the concept of allocative efficiency, not being aware that the condition of allocative efficiency is not consistent with maximisation of consumer benefit, and minimisation of average cost of production. The three perspectives appear to him to be equivalent in defining allocative efficiency.

V Discussion

A Formation of misconceptions

We have identified six ways in which students understand the concept of allocative efficiency. Five of them constitute misinterpretations. The natural question to ask is: How did they acquire these misconceptions? Inaccurate textbook explanation of the concept is one possible cause of some of these misconceptions, a discussion of which is given in Appendix 3 for interested readers. Here, we will explore the cause of the equilibrium perspective, based on the raw data.

Fixation to the D/S Cross – analysis of the cause of the equilibrium perspective

Students learn that a competitive market achieves equilibrium when D = S, and that the equilibrium market output also represents the efficient output (or efficient allocation of resource). They therefore conveniently and rigidly link the three concepts together:
**Equilibrium ↔ D = S ↔ Allocative Efficiency.**

In monopoly, they also learn that the firm’s equilibrium (or profit maximisation) output is determined by \( MR = MC \), not \( D = S \), and the equilibrium output falls short of the competitive output. So, by rigidly applying the ‘\( D = S \)’ criterion, they would think that the monopoly is not efficient because the market is not cleared, and the market is not cleared because \( D \neq S \). In their own words, ‘what is produced is below demand’ (VC). They draw that conclusion without considering the condition of allocative efficiency - equalisation of marginal social benefit and marginal social cost (or maximisation of social surplus). This equilibrium perspective of allocative efficiency is illustrated below.

‘The equilibrium is allocative efficiency in that producer and consumer surplus is maximised as \( MC = MB \). An efficient output is being produced in that there are **no shortages or surpluses**, all that is being produced is being consumed.’

[Answer to part (b)]

‘The above situation [equilibrium in monopoly] is not allocatively efficient in that \( MC \neq MB \). The level of output has created **shortages** in the market. Equilibrium and allocative efficiency are different concepts in that equilibrium explains the level and price of output for the market which can vary depending on the type of market. And allocative efficiency is the net social benefit that can be obtained when all output is consumed and there are **no shortages**.’ (MD2)  [Answer to part (e)]

In this example, note that MD2 correctly focuses on the critical aspect of allocative efficiency (\( MB = MC \)) in his answers to both parts (b) and (c). However, she cannot get rid of the D/S cross and keeps referring back to ‘shortages and surpluses’ to explain why the monopoly market is not allocatively efficient.

To MD2 (and other students holding the equilibrium perspective), the D/S cross represents an ideal market outcome and take the D/S cross as the condition for equilibrium and efficiency, without conceptually differentiating the two concepts. Hence, the formation of the equilibrium perspective, arising from their fixation on the D/S cross.

**B Understanding student misunderstanding**

One crucial contribution from this study is expanding our awareness of students’ different ways of understanding a concept, which enables us to make sense of students’ misconceptions from their perspective. By teasing out the *meaning and structure* of their conceptualisation of a concept, we can better understand their misunderstanding. Two examples will be discussed for illustration.

*Case 1 Self-contradictory?*

In the following answers, what puzzles us most is that the student has made two obvious self-contradictory conclusions.

‘Based on the above answers [in part (c) and (d)] it would indicate that equilibrium and allocative efficiency are **different concepts**. As in the case of the monopolist
poultry farmer, all the available resources were being maximised and could not have been used more efficiently elsewhere to make a greater profit. However, the market was not in equilibrium as the market structure was not perfectly competitive where quantity demanded by consumers equals the quantity supplied by producers. As in this monopoly demands were not properly met, in effect, an inefficient allocation of resources was occurring. Yes allocative efficiency is the same as equilibrium.’

[Answer to part (e)]

At the beginning, he thinks that equilibrium and allocative efficiency are ‘different concepts’, but a few lines later, contradicts himself by saying that the two are in fact the ‘same’. In earlier analysis, we dismissed this as just another nonsensical and trivial mistake. But on further analysis, by following his shift in conceptions, both of his conclusions have begun to make sense (!).

The initial conclusion is based on the profit perspective. Since the monopolist has maximised his profit, allocative efficiency is therefore achieved. (‘As in the case of the monopolist poultry farmer, all the available resources were being maximised and could not have been used more efficiently elsewhere to make a greater profit’. ) The market is, however, not in equilibrium, as monopoly output is less than competitive. Therefore, the student argues logically that allocative efficiency and equilibrium are different concepts. (‘The market was not in equilibrium as the market structure was not perfectly competitive where quantity demanded by consumers equals the quantity supplied by producers.’)

But as soon as he recognises that the competitive equilibrium output (i.e. where D = S) is not achieved in monopoly, he shifts to the equilibrium perspective, evidenced by his remark that ‘in monopoly, demands were not properly met, [and] an inefficient allocation of resources was occurring’. Now, he can discern that the market is in disequilibrium and, at the same time, inefficient allocation occurs in the monopolised market. He therefore ‘logically’ came to the conclusion that equilibrium and allocative efficiency are the same concept.

Case 2 Consistent or inconsistent?

The student below clearly possesses the equilibrium perspective as revealed in his answer in part (b).

‘Yes, allocative efficiency has been achieved [in perfect competition] as the market has cleared ...’

[Answer to part (b)]

‘Equilibrium is not the same as allocative efficiency except in PC [perfect competition]. The above diagram shows how through monopoly power, … a market can reach equilibrium that doesn’t not maximise social welfare by minimising scarcity.’ (PC2) [Answer to part (e)]

In part (e), he points out that in the monopoly ‘market can reach equilibrium’. This implies the market has cleared. If the market has cleared, and if the student faithfully adheres to his equilibrium perspective, then allocative efficiency should be achieved. But, the student later concludes that allocative efficiency is not achieved - ‘the market does not maximise social welfare’ – an inconsistent conclusion.
How to make sense of this inconsistency? This student, like another student discussed earlier, can discern the correct critical aspect of allocative efficiency - maximisation of social welfare, but has herself fixated onto the D/S cross. Maximisation of social welfare and allocatively efficient output is determined by the intersection of demand and supply, any deviation from which is non-optimal. He notices that monopoly equilibrium output is smaller than competitive output. He (incorrectly) took that as meaning the market is not cleared. Hence, the inference that the monopoly has reached equilibrium but the market has not cleared. And since the market has not cleared, from the equilibrium perspective, allocative efficiency is not achieved, and the market is not maximising social welfare.

C  Conceptualising understanding

It amazes us to have observed that even though the topic on allocative efficiency might have been presented in the same way to the students, when asked to explain the concept of allocative efficiency in relation to equilibrium, our students, as their answers reveal, have picked up very different things, and have developed different misconceptions of it. What does it take for a student to develop a proper understanding a concept?

Understanding as awareness of the referential and structural aspects of a concept

From our discussion of the types of misunderstanding, we have pointed out that to fully understand allocative efficiency, the student not only has to discern the critical aspect of the phenomenon (social surplus of production) and its variation (social surplus is maximised in some but not other market situations), but also its relation with other related aspects of the phenomenon (namely, producer and consumer surpluses, marginal social cost and marginal social benefit of production, and deadweight losses). The student needs to bring these related critical aspects and their relation into ‘focal awareness’, and relegate the unrelated aspects (such as minimisation of ATC, equilibrium, distribution of social surplus) into ‘peripheral awareness’ (Marton & Pang, 1999). Using Gestalt Theory, the learner has to see the figure and ground relationship (Marton, 1988) between the critical aspects and unrelated aspects of the concept. To understand allocative efficiency, maximisation of social surplus and its related aspects have to be brought to the foreground and form the figure, with the other unrelated aspects (distribution of the social surplus, minimisation of average cost of production and simultaneous maximisation of consumers’ and producers’ welfare) receding to the background.

The figure-ground relation would have to be reversed if it is a different concept that the student is to understand a different concept. For example, to compare the outcomes in the short run and in the long run of competitive market, the critical aspects of minimisation of average cost of production and profit (and such related aspects as exit/entry, market supply, market price) now would become the figure, while unrelated aspects of equalisation of marginal benefit and marginal cost, and simultaneous maximisation of the producer’s and consumer’s welfare now becomes the ground. When it comes to equilibrium, simultaneous maximisation of values of consumers, and producer(s) would become the figure, while other aspects would recede to the background.

An ability to see the figure and ground of the phenomenon implies discernment of the structural relation between the critical aspects of it. Using the SOLO taxonomy (Biggs &
Collis, 1982), which stands for Structural Of Learning Outcome developed by Biggs and Collis to describe the level of complexity of learning outcome, the student is said to have achieved relational understanding of the phenomenon. On the other hand, if the student can only identify the various aspects separately without bringing them into a relation, this represents understanding at the multi- or uni-structural level (Biggs & Collis, 1982). For example, mere mention of deadweight loss without linking it to maximisation of social surplus (or comparison of marginal social benefit and cost) signifies understanding only at the uni-structural level. Unfortunately students possessing multiple conceptions without developing relational understanding can often score very high marks if those questions assess understanding only up to multi-structural level. In this study for example, quite a few students, like AJC discussed earlier, scores full marks in parts (c) and (d), but fail to correctly distinguish between equilibrium and allocative efficiency. To facilitate conceptual understanding at the relational level, it is therefore necessary that learning experience and assessment be targeted at developing awareness not only of the critical aspects of the concept, but more importantly, of the figure and ground of the phenomenon of interest.

VI Conclusion - Implications for teaching

This study shows that students can understand a concept or a phenomenon from several perspectives, representing different ways of perceiving the figure and ground relation of it, and that some of them manifest multiple conceptions across contexts as well as within a context. This is evident that conceptual development is not a simple process of taking in a new concept from the teacher or text, and by implication, correcting a misconception is not a simple replacement of the wrong conception with the right one. As we have seen, the student can focus on several aspects of the phenomenon and can comfortably shift between several conceptions (multiple conceptions) at the same time without realising any inconsistency. They do so by selecting and interpreting aspects of the concept to fit in to their changing frameworks (Svensson, 1989).

Our analysis of examples of students’ self-contradiction clearly shows that a misconception can have its (at least, partially) coherent and internally logical structure. Therefore, if the student has developed a certain perspective of interpreting a concept, which is structurally ‘logical’, he may twist aspects of the phenomenon to make them compatible with their perspective. As such, misconceptions can be resistant to change.

It is therefore a common and often annoying experience of teachers that the students continue to possess entrenched misunderstanding despite the fact that we have already clearly explained to them its meaning several times. What we have learnt from this study is that as teachers we have to pay attention not only to the meaning of a concept but also its structure. The meaning of a concept, for example in terms of its definition, can easily be ‘taught’ and picked up by most students. But the structure of it can present problems to a lot of them. As revealed from the data, most students could discern and reproduce one or more critical aspects of allocative efficiency when asked, for example in parts (c) and (d) of the exam question. However, when coming to part (e), which assesses relational understanding, many fail to properly relate them to each other, and some incorrectly relate them to unrelated aspects of the phenomenon (e.g. deadweight loss incorrectly related to ‘disincentive to improve’, ‘economies of scale’ or ‘unequal distribution of social surplus’). Therefore, learning activities (including assessment) should be geared towards promoting students’ awareness of the structure of a concept, not only its definitional meaning, by engaging students with active, reflective thinking of it. How
learning activities should be structured to bring about development of such awareness is beyond the scope of this paper.

Finally, when confronted with student misunderstanding, how often do we hear our colleague say to the student: You just don’t understand it! The crucial point coming out of this study is that while it is true that they might not have fully understood the concept, we must also recognise that in fact have understood it in some way. And from their perspective, their misunderstanding can be ‘coherent and meaningful’. By understanding the various ways the students make sense of a concept and its internal logic from their perspective, we are in a vintage position to facilitate student conceptual development. The essence of good teaching is not to brush away students’ mistakes, treating them as irrelevant, and to replace them by reiterating the official version. Our analysis of students’ misunderstanding suggests that student mistakes are important, in the sense that they provide us with a window to their minds, allowing us to understand what aspect(s) of the concept they focus on (meaning of concept), and how they conceptualise it (structure of concept). And as such, student misunderstanding would become the starting point for us to design appropriate learning devices for facilitating students’ conceptual development. This constitutes a relational perspective of conceptualising teaching (Martin & Ramsden, 1992; Ramsden, 1987), which involves our active reflection of how students make sense of and relate to the various aspects of the phenomenon (i.e. the meaning and structure of their awareness). Teaching, if to be effective, has to be interactive and contextualised (Biggs, 1989), i.e.

‘Teachers need to be aware both of the approaches to learning that they engenders, and to assess the outcomes of learning in ways that enable them to see what [ & why] misconceptions persist.’ (Biggs, 1989, P20) [Authors’ addition.]

To conclude, promoting effective teaching is about expanding teachers’ awareness in three related aspects of the teaching/learning process: (1) the referential (i.e. meaning) and structural aspects of content, (2) development of students’ self-awareness of their own learning, and, (3) reflective understanding of the effects of teaching on students’ learning.

Acknowledgement: We thank Bill Heath for his assistance with categorisation of the written statements, and his critical comments.

Reference:


