# IMPROVING TEACHING METHODS THROUGH ADEQUATE FEEDBACK

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**ABSTRACT.** The current paper compares the mechanisms of positive and negative feedback as well as juxtaposes both methods in the so called “combined feedback and feedforward control.” It also looks at the case of no feedback in the system. These four cases of positive, negative, combined feedback and lack of feedback respectively have been applied to forms of teaching evaluations that could improve teaching methods. Teaching methods are the input in the system and evaluation is the output of the system. Both input and output create the full cycle of development of the system initiated by a group, rather than individual action/ perception.

**Key words:** feedback, teaching, system, group action.

**ПОДОБРЯВАНЕ НА МЕТОДИТЕ ЗА ПРЕПОДАВАНЕ ЧРЕЗ АДЕКВАТНА ОБРАТНА ВРЪЗКА**

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**РЕЗЮМЕ.** Настоящата статия сравнява механизмите на позитивна и негативна обратна връзка и съвместява двата метода в т.нар. „комбинирана обратна връзка и контрол с пренасочване“ или движение напред. Също така е разгледан случаят с липса на обратна връзка в системата. Тези четири случая, съответно на позитивна, негативна, комбинирана и липса на обратна връзка, са приложени към формите на оценяване на обучението, които могат да подобрят методите за преподаване. Методите за преподаване са разгледани като вход в системата, а оценяването - като изход на системата. И вход, и изход създават пълен цикъл на развитие на системата, развитие, инициирано от групови, а не индивидуални действия/ възприятия.

**Ключови думи:** обратна връзка, преподаване, система, групово действие.

## Introduction

The paper applies mostly the concept of feedback, typical for system analysis. The area of application is education where teaching methods represent the input in the system and teaching evaluation - the output of the system. The system is complex, open, and adaptive.

## Types of Feedback

The focus is on complex systems that have prototypes in living organisms. More specifically that includes liner, time-invariant systems, i.e. causal systems with feedback (Ferdinandov 1999: 264). Feedback analysis generally demands reverse analysis of the signal or analysis of how the output signal changes the input system. Thus, the structure of systems with feedback consists of two sub-systems, also causal invariant linear systems, namely direct sub-system (from input to output) and reverse sub-system (from output to input) (*ibid.*: 265).

There are three main types of feedback: negative, positive and neutral. Negative feedback initiation decreases the module of the output signal. Positive feedback initiation increases the module of the output signal (*ibid*: 265). Neutral feedback is neither negative nor positive (*ibid.*: 271). A special case is the lack of feedback (*ibid.*: 272).

The effects of negative and positive feedback are diametrically opposite and do not correspond to the connotation of the words “negative” and “positive”. Rather, negative feedback has positive effect and positive feedback has negative effect. The effect of negative feedback is the stabilisation of unstable invariant linear system, while maintaining its causality (*ibid.*: 284). The effect of positive feedback is the destabilisation of stable invariant linear systems, the latter being stable in lack of feedback (*ibid.*: 288). Their direction is also opposite: positive feedback moves anticlockwise and negative feedback moves clockwise (*ibid.*: 301). Both types of feedback could produce a whole cycle in the system.

This full cycle is composed of both linear and non-linear systems. The system is linear if “a change in input signal level causes a proportionate change in the output” (Martens and Allen 1969: 5). Otherwise it is nonlinear. The system in itself connects cause to effect, or an input to an output (*ibid.*: 1).

The control in the system can be performed by the hierarchy of the system and by means of information and communication. In the case of closed-loop systems, control has been performed by regulatory mechanisms called feedback and feedforward (Skyttner 2005: 81). Feedforward is

a preliminary control, carried out before the occurrence of the event and it is part of the planning process.

Feedback allows for the system to compensate abrupt and sudden disturbances. Feedback is a transfer of signal from a later to an earlier stage, it has been activated by error and serves for correction of the functioning of an aggravating system. Feedback, as already stated, could be positive and negative. Negative (more leads to less) is similar to the idea of diminishing returns, recovery of the normal state, a favourable cycle (*ibid.*: 83). Positive feedback is a deviation, unfavourable cycle (arms race for example) (*ibid.*: 84).

The concept of “adequate” feedback depends on the introduction of some other concepts, typical to the system theory, as causality and complexity of the system. Adequate feedback is neither good nor bad but rather a feedback based on situational analysis. Even the lack of feedback could be adequate if the system is complex enough to make decisions based on self-regulating mechanisms.

## Causality, Equilibrium, Complexity of Systems

Negative and positive feedback have different causality principles. In the case of a negative feedback, the state of equilibrium of the system is invariant in different initial states (equifinality). In the case of a positive feedback, radically different final states are possible in same initial conditions (multi-finality) (*ibid.*: 101).

Feedback is “transmission of information” (Checkland 1981: 85) regarding the functioning or performance of a machine to a previous stage with the aim of modifying its operation. Positive feedback is an evolutionary cycle of growth, a self-accelerating system either under the form of regenerative dynamics (growth) or degenerative dynamics (aggravation). The system usually breaks in case of lack of feedback (Geirgiou 2007: 6). Thus, negative feedback is purposeful, adapting the system to equilibrium nodes. Most systems consist of interconnected positive and negative feedback and complexity makes it difficult to recognise what causes what (*ibid.*: 7). The significance of feedback is that it reveals how the system causes its own behaviour (*ibid.*: 9).

Negative feedback diminishes the difference between the actual and the desired functioning or performance of the system. Positive feedback leads to instability, modified functioning (Checkland 1981: 85). In the case of a positive feedback the state of the system deviates from the reference state and this leads to instability. In the case of a negative feedback, there is self-regulation, returning to the natural state of equilibrium. Positive and negative feedback differ from the colloquial meaning of good and bad feedback (Daellenback 1994: 42).

Despite the context, three types of decisions of the actors are possible: 1) feedback-competition, 2) feedback-cooperation, 3) lack of feedback (Pillutla, Chen 1999: 90). In the case of complex systems, there is interdependence of the cycles of positive and negative feedback. The feedback cycles are regulatory or control processes. They could be two types. The cycle of a negative feedback is directed to achieving and/or maintaining a targeted state, stability and balance according to a defined reference norm. The cycle of the positive feedback is directed to a cumulative change of a given state, deviates from the purpose, and produces unstable equilibrium (growth or decay).

The system of negative feedback includes a homeostatic process, maintaining stability or self-correcting mechanism (Baumgartner, Jones 2002: 8). This is a mechanism of diminishing returns and an example could be the standard operating procedures. The mechanism of positive feedback is a self-accelerating process, positive return of scale and the example could be the behaviour of group imitation (*ibid.*: 15).

The processes of positive feedback are called path dependent processes, characterised by relative “openness” of earlier stages compared to the relatively closed character of later stages in the sequence (Pierson 2000: 75). An example of positive feedback is self-fulfilling prophecies (*ibid.*: 77).

Feedback is a central concept in system analysis, maintaining the wholeness of the system. Feedback has been performed by exchange of information and communication. Feedback is a regulatory process, controlling the system after the occurrence of disturbances. Negative feedback leads to stability, positive feedback leads to abrupt change but the total system has elements from both types. Competition, cooperation, and lack of feedback are three possible types of behaviour of the actors.

## Teaching Methods as Input

Teaching methods could be considered as input in the system.

On the one hand, based on the results of teaching methods in terms of students’ performance, there are three types of methods: 1) teacher-centred, 2) student-centred and 3) teacher-student interactive method (Ganyaupfu 2013). The movement from the first to the third is actually a movement from passive methods (of just obtaining information) to active engagement methods (of active engagement). Passive methods could even be characterised by lack of feedback.

The teacher-centred method focuses on theory and memorising as opposed to the so called activity based learning or learning by doing. This method is probably useful for teaching rules, definitions, and procedures (*ibid.*: 30).

The student-centred method encourages critical thinking, active and discovery learning (a self-directed learning process). This method is not centralised and improves students’ performance since it is goal oriented (*ibid.*). The combined teacher-student interactive method stimulates students’ initiative in searching for relevant information, thus distributing the load and responsibility between students and teacher. Feedback is a must in this type of teaching method. This method is also considered the most effective.

On the other hand, based on the desired learning outcomes, three other types of teaching method could be mentioned: 1) cognitive development methods, 2) affective development methods, 3) psychomotor development methods (Dorgu 2015: 80). Again, the movement from the first to the third requires more feedback. In this respect, teaching methods are seen as causal factors of learning outcomes. Learning outcomes on their part develop different skills. As complex skills are necessary for contemporary education, it could be suggested that a combination of methods has to be applied for best results.

Cognitive development methods are intended to teach and instruct and they are kind of similar to teacher-centred methods. Intellectual skills are developed in this case. However, this instruction could lead to a shift in moral values

as well. Cognitive development methods could take the form of a monologue, discussion, team teaching, questioning, or field trip.

Affective development methods are intended to develop appreciation and adjustment and are similar to student-centred methods. Changes in interest, attitudes, and values are encouraged to develop as a final result. These methods could take the form of modelling, simulation, non-verbal communication, and role-playing.

Psychomotor development methods are intended to develop dexterity and discovery. They are student-centred and teacher-student interactive. Creativity is developed in this case. These methods could take the form of an inquiry, discovery, creative writing, demonstration, experimentation, programmed learning, individual-pace method, and project assignment. Science subjects are better taught with these types of methods.

## Types of Evaluation as Output

Types of evaluation could be considered as the output of the system.

From the standpoint of students' satisfaction, useful feedback could be gathered through student ratings when it comes to classroom observation, peer review when it comes to evaluation of a discipline, and instructor self-assessment when it comes to self-improvement (Benton and Young 2018: 3).

The typical distinction between the types of evaluation includes summative or more general and formative or more recommendation-based types of evaluation. Summative evaluation is subjective and “sums up” with the conclusion of whether someone teaches effectively or not. Formative evaluation is a more meaningful task because it gives recommendations for improving behaviour and encourages changes in method or style.

Generally, evaluation is supposed to end the cycle of the education system. However evaluation could be just a form of feedback mechanism that maintains circularity of the system. The suggestion here is that group perception is more adequate than individual perception.

If we go beyond teaching methods, as Bernard Ricca suggests (2012), then we have to consider a complex, non-linear system. This system combines bottom-up and top-down processes that complement each other (*ibid.*: 37). The combination of processes involves simultaneous consideration of two directions: from smaller to larger systems and vice versa, as well as self-reflection of the system upon its structure.

## Conclusion

System stability and development complement each other. Systems require feedback for the purposes of control and adjustment. Positive and negative feedback could produce a cycle in the system. Lack of feedback has no negative result in stable systems, usually complex ones. Generally, systems with negative feedback are more stable because of the self-regulation mechanisms. A system has elements from both types of feedback.

Teaching methods and teaching evaluation are more important as the two final ends of the system in the case of teacher-student interactive methods and the psychomotor development methods. Evaluation itself has to take several forms in order to consider not only subjective perceptions but substantive suggestions as well as instructors', and why not students', self-evaluation. After all, actors decide whether their system is based on competition, co-operation, or lack of feedback. Once that issue is solved, feedforward is an issue of next level development.

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