Measurement Instrument for Determinants of Innovations (MIDI)

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CONTENTS

1 DESCRIPTION OF MEASUREMENT INSTRUMENT

1.1 Background

In 2004, we published a list of 50 potentially relevant determinants of the implementation of innovations. That list was based on a systematic review of empirical studies and a Delphi study involving implementation experts. Ten determinants have since been added to the original list on the basis of empirical studies published later. The determinants were broken down into categories depending on 1) the innovation, 2) the potential user of the innovation, 3) the organisation where the potential user works and 4) the socio-political context.

Since 2002, the list has been used in eight empirical studies looking at the implementation of evidence-based innovations – national guidelines and curriculum innovations – in preventive child health care and in primary and secondary schools. Each study used a similar method to assess the determinants and the implementation of the innovation. Data from these eight empirical studies were combined to form a single data set. Missing values in the final data set were replaced by plausible values using multiple imputation. We looked at which determinants 'predicted' implementation, separately and in combination with one another. In addition, twenty-two implementation experts commented on the results of the meta-analyses.

The list of 60 potentially relevant determinants was reduced to 29. Twenty-one determinants are based on the meta-analyses, 7 on the theoretical expectations of the experts consulted and 1 new determinant has been added on the basis of the experts' advice.

Applicability and ongoing development

We were not able to check whether the results could be generalised to settings other than Preventive Child Health Care and schools. Nevertheless, the instrument may be applicable to a broader range of settings. First, the original list of determinants stemmed from many different health care settings. Second, the experts in the present study, as well as in a Delphi study performed previously [Fleuren et al., 2004], found that the determinants were generic.

The MIDI is not a validated instrument and we have no cut-off points for the scores for each determinant. We will be continuing to refine the instrument on the basis of incoming data, focusing on validation and the determination of cut-off points for the scores for each determinant. We invite implementation researchers to further explore the predictive validity of the MIDI in multiple settings, and to report and share their results.

1.2 Intended use

The Measurement Instrument for Determinants of Innovation (MIDI) can be used either before or after the introduction of an innovation. The instrument is designed to improve our understanding of the critical determinants that may affect implementation in order to better target the innovation strategy. The instrument is intended primarily for implementation researchers, but can also be used by implementation consultants/advisors. We expect the instrument to help collect information that will result in an empirically grounded assessment of the relative importance of determinants, which is a pre-requisite for planning innovation strategies.

1.3 Concepts

Innovation. Innovations include, for instance, guidelines, protocols or programmes that are entirely or partly new for the intended group of users.

End user. Person or persons primarily targeted by an innovation (client, patient, pupils or other public groups)

Intermediary user. Professionals whose actions determine the degree of exposure of end users to the innovation (doctors, nursing staff, teachers etc.).

Implementation. Implementation differs from the preceding phase - adoption - in which people initially acquire and process information about the innovation and make their decision about using the innovation (= behavioural intention). In the implementation phase, the innovation is put into daily practice by intermediary professionals (= behaviour).

1.4 The measurement instrument in use

1. The list was developed for use in research looking at intermediary users of the innovation. It looks at intermediary users' perceptions relating to an innovation, which may be based on expectations or on experience with the innovation or components of the innovation.
2. The researchers themselves must decide which determinants they will measure. The main criterion is the anticipated impact of the determinant on possible variations in levels of use. For example, the characteristics of the socio-political context will often not vary to a large extent when an innovation is adopted at different locations in the same region or country. This is the case in Dutch child health care, where legislation and regulations will differentiate little, if at all, between organisations. However, in international research, this may be an extremely relevant factor when comparing different countries in terms of variations in the level of implementation of a particular innovation.

3. The researchers themselves must decide which determinants they believe are critical enough to be included in their study and in their decisions about the design of implementation strategies.
4. The researchers themselves should replace the term `innovation` by the name of the innovation under consideration. For example: the guideline for cardiac arrest, the lessons relating to bullying etc.
5. For reasons of readability, the list does not use the term 'end user' but 'client'. The researchers themselves should enter the name of the end user. For example: patient, pupil, member of the public, etc.
6. In the case of many of the determinants, several questions relate to a single underlying construct. For example, when assessing self-efficacy, a number of questions will be used, each referring to a skill that is assumed to be critical for the intended implementation of the innovation. After scale analysis (for example the determination of internal consistency), a single composite score will preferably result for each determinant. Where relevant, this will be stated in the instrument in a note accompanying the determinant. The researchers themselves should determine the optimal balance between practicality and the precision/reliability of the questionnaire used to assess the determinants.
7. It is sometimes neither feasible nor possible to measure particular determinants before the innovation is implemented because the user will not have a clear picture of what the innovation entails. For example, a subjective assessment of the innovation will not be possible when the intended users are not yet familiar with the particular characteristics of the innovation.
8. The response scales presented range from negative to positive. The expected associations between the determinants and use are positive for almost all determinants: the higher the score, the higher the expected level of use. When this is not the case, it is stated that a determinant should be scored inversely.

1.5 Overview of determinants in the MIDI

Determinants associated with the innovation	
1 Procedural clarity (e)	5 Compatibility (e)
2 Correctness (e)	6 Observability (e)
3 Completeness (e)	7 Relevance for client (e)
4 Complexity (e)	
Determinants associated with the adopting person (user)	
8 Personal benefits/drawbacks (e)	14 Descriptive norm (e)
9 Outcome expectations (e)	15 Subjective norm (e)
10 Professional obligation (t)	16 Self-efficacy (e)
11 Client/patient satisfaction (e)	17 Knowledge (t)
12 Client/patient cooperation (t)	18 Awareness of content of innovation (e)
13 Social support (e)	
Determinants associated with the organisation	
19 Formal ratification by management (e)	24 Material resources and facilities (t)
20 Replacement when staff leave (e)	25 Coordinator (e)
21 Staff capacity (t)	26 Unsettled organisation (p)
22 Financial resources (t)	27 Information accessible about use of the innovation (e)
23 Time available (e)	28 Performance feedback (e)
Determinants associated with the socio-political context	
29 Legislation and regulations (t)	

(e) based on the meta-analyses of the *empirical* data

(t) based on *theoretical* expectations of implementation experts

(p) based on *practical* experience of implementation experts

2 MEASUREMENT INSTRUMENT: DESCRIPTION AND OPERATIONALISATION OF DETERMINANTS

2.1 Determinants associated with the innovation

Determinant 1	**Procedural clarity**
Description	Extent to which the innovation is described in clear steps / procedures.
Operationalisation	The innovation clearly describes the activities I should perform and in which order. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 2	**Correctness**
Description	Degree to which the innovation is based on factually correct knowledge.
Operationalisation	The innovation is based on factually correct knowledge. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 3	**Completeness**
Description	Degree to which the activities described in the innovation are complete.
Operationalisation	The innovation provides all the information and materials needed to work with it properly. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 4	**Complexity**
Description	Degree to which implementation of the innovation is complex.
Operationalisation	The innovation is too complex for me to use. Response scale: (5) totally disagree, (4) disagree, (3) neither agree nor disagree, (2) agree, (1) totally agree

Determinant 5	**Compatibility**
Description	Degree to which the innovation is compatible with the values and working method in place.
Operationalisation	The innovation is a good match for how I am used to working. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 6	**Observability**
Description	Visibility of the outcomes for the user, for example whether the outcomes of a particular treatment are clear to the user.
Operationalisation	The outcomes of using the innovation are clearly observable. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 7	**Relevance for client**
Description	Degree to which the user believes the innovation is relevant for his/her client.
Operationalisation	I think the innovation is relevant for my clients. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

2.2 Determinants associated with the user

Determinant 8	**Personal benefits/drawbacks**
Description	Degree to which using the innovation has advantages or disadvantages for the users themselves.
Operationalisation	To what extent does using the innovation have personal benefits/drawbacks for you? This question is asked for each concrete benefit or drawback that is expected to be salient for the particular user population. Response scale advantages: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree Response scale disadvantages: (5) totally disagree, (4) disagree, (3) neither agree nor disagree, (2) agree, (1) totally agree

Note Example from a programme for preventing bullying at schools: "To what extent does the programme provide you with the following personal advantages or disadvantages: a. Using the programme means that I spend less time on maintaining order, b. Using the programme means that I can make significant improvements in my relationships with pupils."

- The advantages and disadvantages are now specified for the intermediary user. However, depending on the aim of the innovation, they can also be specified for the organisation.

Determinant 9 **Outcome expectations**

Description Perceived probability and importance of achieving the client objectives as intended by the innovation

Operationalisation Composite measure: the product of *importance* and *probability*

These questions about the importance and probability are asked for each objective separately.

Importance

I think it is important to achieve the following objectives for my client …[state objectives].

Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Probability

I expect that using the innovation will actually achieve the following objectives for my client …[state objectives].

Response scale: (1) most definitely not (2) definitely not (3) perhaps not, perhaps (4) definitely (5) most definitely

Note Example from a programme for the prevention of passive smoking: "I think it is important for my clients to achieve the following objectives: a. Parents should be more aware of the harmful impact of passive smoking on young children, b. Parents should introduce house rules that make sure they smoke less when young children are present".

In combination with:

"I expect that the programme will achieve the following objectives: a. Parents will be more aware of the harmful impact of passive smoking on young children, b.

Parents will introduce house rules that make sure they smoke less when young children are present".

- In the case of importance, the following weightings are used for the response scales: entirely disagree = 0; disagree = 1; neither agree nor disagree = 2; agree = 3; agree entirely= 4.
  In the case of probability, the following weightings are used for the response scales: most definitely not = 1; definitely not = 2; perhaps not, perhaps = 3; definitely = 4; most definitely = 5.
  Importance and probability are then multiplied for each objective. Then all the products are added and divided by the number of objectives.
- Questions about importance may be omitted if, for example, the questionnaire is getting too long. The composite measure for outcome expectations will then be the sum score of the probability items divided by the number of items.
- The objectives are now specified for the end user. However, depending on the aim of the innovation, they can also be specified for the organisation (and its interests).

Determinant 10	**Professional obligation**
Description	Degree to which the innovation fits in with the tasks for which the user feels responsible when doing his/her work.
Operationalisation	I feel it is my responsibility as a professional to use this innovation. This question is asked for each activity in the innovation. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree
Note	Example from a programme for the prevention of passive smoking: "As a doctor in child health care, I feel it is my responsibility to educate parents about passive smoking." "As a doctor in child health care, I feel it is my responsibility to inform all parents about the harmful effects of passive smoking on young children".

Determinant 11	**Client satisfaction**
Description	Degree to which the user expects clients to be satisfied with the innovation.
Operationalisation	Clients will generally be satisfied if I use this innovation. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 12	**Client cooperation**
Description	Degree to which the user expects clients to cooperate with the innovation.
Operationalisation	Clients will generally cooperate if I use this innovation. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 13	**Social support**
Description	Support experienced or expected by the user from important social referents relating to the use of the innovation (for example from colleagues, other professionals they work with, heads of department or management).
Operationalisation	I can count on adequate assistance from my colleagues if I need it to use the innovation. This question is asked for important social referent group or person inside or outside the organisation (colleagues, immediate hierarchical superior, management, professionals involved in the delivery of care etc.). Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree
Note	Example from a screening guideline for congenital heart disorders: “I can count on adequate assistance from my boss when it comes to working in accordance with the guideline”. “I can count on adequate assistance from the management when it comes to working in accordance with the guideline”. “I can count on adequate assistance from professionals involved in the delivery of care when it comes to working in accordance with the guideline”.

Determinant 14	**Descriptive norm**
Description	Colleagues' observed behaviour; degree to which colleagues use the innovation.
Operationalisation	In your opinion, what proportion of the colleagues in your organisation for whom the innovation is intended actually use the innovation? Response scale: (1) not a single colleague (2) almost no colleagues (3) a minority (4) half (5) a majority (6) almost all colleagues (7) all colleagues.

Determinant 15	**Subjective norm**
Description	The influence of important others on the use of the innovation.
Operationalisation	Composite measure: the product of *normative beliefs*[1] and *motivation to comply*[2] These questions about normative beliefs and motivation to comply are asked for each referent person/group inside or outside the organisation (colleagues, heads of department, management, clients etc.). *Normative beliefs* To what extent do the following people [list people] expect you to use the innovation? Response scale: (1) most definitely not (2) definitely not (3) perhaps not, perhaps (4) definitely (5) most definitely *Motivation to comply* When it comes to working in accordance with the innovation, to what extent do you comply with the opinions of the following people [list people]? Response scale: (1) very little (2) little (3) not a little, not a lot (4) a lot (5) a great deal

Note	Example from a guideline for screening for congenital heart disorders: "To what extent do the following people [list people] expect you to use the guideline: a. doctors in your department, b. nursing staff in your department, c. your immediate superior, d. parents?" In combination with: "When it comes to using the guideline, to what extent do you comply with the opinions of the following people [list people]: a. doctors in your department, b. nursing staff in your department, c. your immediate superior, d. parents?"

[1] Perceived expectation of important others about the use of the innovation.
[2] Degree to which somebody tends to pay attention to the expectations of those important others.

- In the case of normative beliefs, the following weightings are used for the response scales: most definitely not = -2; definitely not = -1; perhaps not, perhaps = 0; definitely = +1; most definitely = +2.
  In the case of motivation to comply, the following weightings are used for the response scales: very little = +1; little = +2; not a little, not a lot = +3; a lot = +4; a great deal = +5.
  Normative beliefs and motivation to comply are then multiplied for each person/group of people involved. Then all the products are added and divided by the number of referents.
- The question about motivation to comply can possibly be omitted, if the questionnaire is getting too long. In that case, the determinant will be referred to as 'normative beliefs': the expectation of important others about the use of the innovation. The composite measure will then be established solely on the basis of the items relating to normative beliefs.

Determinant 16	**Self-efficacy**
Description	Degree to which the user believes he or she is able to implement the activities involved in the innovation.
Operationalisation	Should you wish to do so, do you think you can put [state activity from the innovation] into practice? This question is asked for each activity in the innovation. Response scale: (1) most definitely not (2) definitely not (3) perhaps not, perhaps (4) definitely (5) most definitely
Note	Example from a programme for the prevention of passive smoking: "Should you want to, do you think you could manage to complete the intervention chart for every infant in your care?", "Should you want to, do you think you could manage to complete all stages of the plan for all the infants in your care?"

Determinant 17	**Knowledge**
Description	Degree to which the user has the knowledge needed to use the innovation.
Operationalisation	*Objective measurement* with a knowledge test including a range of questions. *Subjective measurement* with one question: I know enough to use the innovation. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree
Note	The best approach is to assess knowledge objectively using a test. If this is not possible, a subjective assessment can be made with one question.

Determinant 18	**Awareness of content of innovation**
Description	Degree to which the user has learnt about the content of the innovation.
Operationalisation	To what extent are you informed about the content of the innovation? Response scale: (1) I'm not familiar with the innovation (2) I'm familiar with the innovation, but I haven't read it through (yet) (3) I'm familiar with the innovation and I've glanced through it (4) I'm familiar with the innovation and I have read through it thoroughly

2.3 Determinants associated with the organisation

Determinant 19	**Formal ratification by management**
Description	Formal ratification of the innovation by management, for example by including the use of the innovation in policy documents.
Operationalisation	Has the management set up formal arrangements in your organisation relating to the use of this innovation (in policy plans, work plans and so on)? Response scale: (1) no (2) yes

Determinant 20	**Replacement when staff leave**
Description	Replacement of staff leaving the organisation
Operationalisation	In my organisation, there are arrangements in place so that staff who use the innovation and leave the organisation are replaced in good time by employees who are/will be adequately prepared to take over. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 21	**Staff capacity**
Description	Adequate staffing in the department or in the organisation where the innovation is being used.
Operationalisation	There are enough people in our organisation to use the innovation as intended. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 22	**Financial resources**
Description	Availability of financial resources needed to use the innovation.
Operationalisation	There are enough financial resources available to use the innovation as intended. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 23	**Time available**
Description	Amount of time available to use the innovation.
Operationalisation	Our organisation provides me with enough time to include the innovation as intended in my day-to-day work. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 24	**Material resources and facilities**
Description	Presence of materials and other resources or facilities necessary for the use of the innovation as intended (such as equipment, materials or space).
Operationalisation	Our organisation provides me with enough materials and other resources or facilities necessary for the use of the innovation as intended. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 25	**Coordinator**
Description	The presence of one or more persons responsible for coordinating the implementation of the innovation in the organisation.
Operationalisation	In my organisation, one or more people have been designated to coordinate the process of implementing the innovation. Response scale: (1) no (2) yes

Determinant 26	**Unsettled organisation**
Description	Degree to which there are other changes in progress (organisational or otherwise) that represent obstacles to the process of implementing the innovation, such as re-organisations, mergers, cuts, staffing changes or the simultaneous implementation of different innovations.
Operationalisation	Are there, in addition to the implementation of [describe innovation], any other changes in the organisation affecting the implementation of the innovation now or in the foreseeable future (reorganisation, merger, cuts, staffing changes, other innovations)? Response scale: (2) no (1) yes

Note	This determinant was included on the basis of the practical experience of a number of implementation experts. The relationship with use will have to be explored in future empirical research.

Determinant 27	**Information accessible about use of innovation**
Description	Accessibility of information about the use of the innovation.
Operationalisation	It is easy for me to find information in my organisation about using the innovation as intended. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

Determinant 28	**Performance feedback**
Description	Feedback to the user about progress with the innovation process.
Operationalisation	In my organisation, feedback is regularly provided about progress with the implementation of the innovation. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree

2.4 Determinants associated with the socio-political context

Determinant 29	**Legislation and regulations**
Description	Degree to which the innovation fits in with existing legislation and regulations established by the competent authorities (examples being financial structures, or substantive legislation and supervision from the Dutch Health Care Inspectorate or the Dutch Care Authority).
Operationalisation	The activities listed in the innovation fit in well with existing legislation and regulations. Response scale: (1) totally disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) totally agree
Note	Implementation experts think this is an important determinant in terms of the boundary conditions. However, this determinant will not result in differentiation with respect to the implementation of many innovations because the context of the innovations will be the same.

3 CRITERION VARIABLE: MEASURING USE

3.1 Core elements of the innovation

To assess the use of an innovation, it is necessary to identify first the components that make up the innovation. This requires a meticulous analysis of the activities/sub-activities that need to be implemented in order to meet the criterion “use as intended by the developers”. As a rule, the developers of the innovation will make explicit which core elements/activities they think are critical for the innovation to be implemented as intended. In addition, it can be relevant to identify activities that should preferably be avoided because they are harmful or, in any case, may negate the intended effect on the end user.

To assess the use of each core element of the innovation, the developers must state which elements they expect to be critical to achieve the intended effects in clients.

3.2 Measurement methods and use measure

Several dimensions can be identified in the rather broad concept of the "use" of an innovation. “Fidelity” and “completeness” are terms that are widely used in papers describing evaluation studies looking at the extent of innovation implementation. "Fidelity" refers to use as intended by the developers of the innovation. The central question here is the extent to which all the proposed methods and activities included in the innovation have been put into practice by users as intended. A considerable range of use indicators can be involved, such as the content and quality of the implementation, the number of people using the innovation, the number of end users they reach, the frequency of use, the timing/duration of the exposure of end users to the innovation, and so on. Completeness is a further specification here and it is a widely, if not the most frequently, applied measure in implementation research. This quantifiable measure represents the proportion of the total number of prescribed elements that are actually implemented by the intermediary user. The variable obtained therefore varies from 0% (no use) to 100% (full use). When developers do not make explicit in advance the core elements of the innovation, a post hoc procedure is often used to establish consensus between the researcher and the developer(s) about the core elements/activities of the innovation. That procedure will establish a measure for completeness that is both specific and internally consistent with the innovation at hand. These core elements/activities are operationalised as items that can be submitted to users in the form of a questionnaire or logbook, asking them whether they actually implement the core elements/activities concerned.

Questionnaires, registration forms, digital files, analysis of distributed materials, etc. are generally suitable for measuring the quantitative aspects of use: has a core element been implemented?

Observations, interviews or focus groups etc. are often more suitable for measuring the qualitative aspects of use.

Caveat

Completeness of use was also the criterion variable for the meta-analyses on which the present measurement instrument was based. The original studies that were used had this measure in common. This reflects a major limitation in the measurement instrument presented here. Completeness does not cover all the conceivable dimensions of use, and particularly not those associated with the quality of implementation. In the case of some innovations, particularly social innovations, the quality of delivery may be an important factor in terms of understanding why the anticipated effects of the innovation fail to materialise. For example, in a guideline for the prevention of child abuse, a core element is that the professional should provide the client with relevant information. In the case of an intervention at a school, a core element will be the organisation of a group discussion by the teacher. In these cases, the question is not just *whether* the professional has completed the activity, but also *how*. For example, was the discussion adapted to the level of knowledge and the specific circumstances of the client/pupil? In these examples, the interaction between the professional and the client, or the teacher and the pupils, is important and these areas are not covered by merely measuring "completeness".

However, the current state of the art does not (as yet) provide us with any generally accepted approach for the adequate measurement of qualitative issues of this kind in a standardised way. Future research in that direction is needed to smooth the way for a meta-analysis of determinants of quality issues relating to use that are considered to be important in particular cases.

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