

## Assessing Self-directed Active Learning in Primary Schools

Menucha Birenbaum

To cite this article: Menucha Birenbaum (2002) Assessing Self-directed Active Learning in Primary Schools, *Assessment in Education: Principles, Policy & Practice*, 9:1, 119-138, DOI: [10.1080/09695940220119229](https://doi.org/10.1080/09695940220119229)

To link to this article: <http://dx.doi.org/10.1080/09695940220119229>



Published online: 09 Jun 2010.



Submit your article to this journal [↗](#)



Article views: 835



View related articles [↗](#)



Citing articles: 4 [View citing articles](#) [↗](#)

# Assessing Self-directed Active Learning in Primary Schools

MENUCHA BIRENBAUM

*School of Education, Tel Aviv University, Ramat Aviv 69978, Israel*

*ABSTRACT The project reported in this paper developed an empirically based multi-dimensional assessment of self-directed learning through inquiry for use in primary schools that want to promote self-directed active learners. Development of the assessment tools and initial findings regarding validity and reliability of the assessment are reported. Intended and actual usage of the tools are discussed and suggestions for further study are offered.*

## Introduction

Regulation of learning activities is an essential dimension along which styles of teaching and learning at all levels of education can be described (Lonka & Lindblom-Ylänne, 1996; Vermunt, 1996). One pole represents external regulation, where the teacher takes over learning and thinking activities from students (e.g. explains relationships between concepts or theories, makes comparisons, draws conclusions, etc.), whereas at the other pole, representing internal regulation, students perform learning and thinking activities. The latter pole is the focus of this study and will henceforth be referred to as self-directed active learning (SDAL). Promoting SDAL has become the goal of education in the 21st century with its demand for successful functioning in the 'knowledge age'. There are many definitions of SDAL, but it is commonly agreed that it refers to the degree that students are metacognitively, motivationally and behaviourally active in their learning. The cognitive, metacognitive and resource management strategies they activate, in combination with related motivational beliefs, help them accomplish their academic goals and overcome obstacles that occur along the way (Zimmerman, 1989; Pintrich, 2000; Randi & Corno, 2000; Schunk & Ertmer, 2000). Self-directed learning entails the capability of assimilating new knowledge and applying it to solve problems, the ability to think critically and perform self-assessment as well as that of communicating and collaborating with others (Cornish, 1986; Resnick, 1987).

Key concepts in an instructional approach guided by an SDAL perspective include construction of knowledge, disciplined inquiry, an interdisciplinary curriculum, authentic tasks, collaborative learning and teaching, teacher-student dialogue, reflection and self- and peer-assessment (Langer, 1989, 1993; Resnick & Klopfer,

1989; Perkins, 1992; Grennon Brooks & Brooks, 1993; Newmann & Wehlage, 1993). School reform efforts in this direction require a change in the role of teachers and students as well as organisational changes in the school regarding time and space. The curriculum is based on an interdisciplinary approach involving the students in extended project work; flexible time blocks replace the conventional 45 minute class periods; walls are knocked down in favour of open spaces allowing many students to work individually or in small groups in the same time block; students become active constructors of knowledge instead of passive recipients of it; teachers become active learners themselves instead of purveyors of knowledge (Sizer, 1992, 1996).

The purpose of the project reported in this paper was to develop an empirically based Teacher's Guide for multi-dimensional assessment of SDAL in the primary school. The project was commissioned and sponsored by the Israeli Ministry of Education, Department of Primary Education, as one of its initiatives to provide teachers with tools to promote SDAL. Before describing the current project a brief outline of the Israeli education system and its policy regarding the promotion of SDAL would be useful, given the international nature of this journal.

Israel has a centralised education system. According to the State Education Law, 1953, state education is defined as education provided by the state on the basis of the curriculum approved by the Minister of Education and under his or her supervision. Yet this law enables the Minister of Education to approve, at the request of 75% of the parents, an additional institutional curriculum comprising up to 25% of the existing curriculum or an additional curriculum financed by the local authority or by the parents. (State of Israel Ministry of Education, Culture and Sport, 1998).

The school system is structured as follows: 6 years of primary education (Grades 1–6), three years of middle school (Grades 7–9) and three years of high school (Grades 10–12). Maintenance of official educational institutions is the joint responsibility of the state and the local education authority.

The Ministry of Education conducts three types of assessment at the national level: (i) matriculation examinations at the end of high school; (ii) national assessment tests (NATs) (tests in mathematics and literacy administered every 4 years to a representative sample of students from Grades 4 and 8); (iii) school-based assessment (developing national banks of performance tasks for primary and middle schools in order to improve instruction through assessment) (State of Israel Ministry of Education, Culture and Sport, 1998).

The current policy of the Ministry of Education with respect to primary education is aimed at school restructuring in order to fit with the requirements of life in the knowledge age. Promotion of SDAL is one of the steps towards this goal. This involves redefining the role of the teacher and the nature of the curriculum and it requires bestowing a certain level of autonomy on the schools. A recent issue of the policy guidelines issued by the Director General of the Ministry of Education [1] (Ministry of Education, 2000) regarding the required organisation of the pedagogical practice, reflects the current policy in this regard. Following are some excerpts from this document which refer to the promotion of SDAL as it relates to curricu-

lum structure, instruction principles and organisation of time schedule in primary schools.

Among the aims stated in the document is the following: ‘emphasising the individuality of each pupil in order to develop a self-directed learner who is curious, an active participant in constructing his/her knowledge ...’ (p. 4).

Among the learner characteristics that the primary education system is expected to strive to develop the document lists the following:

- (a) A learner who is characterised by curiosity and intellectual interest which originates in his/her desire to understand various subjects. A learner who, through his/her own enterprise, is able to locate the information and the tools necessary for satisfying his/her curiosity and interest (p. 4).
- (b) A learner who is engaged in areas that are of genuine interest to him/her, according to personal choice ... (p. 4).
- (f) A learner who is aware of him or herself, who can define and plan personal and social goals as well as design the means for their attainment, and who is able to undertake roles and accept responsibility (p. 5).

School autonomy is mentioned in the section about the features of the curriculum, where it is stated that

The school staff, being familiar with the needs of the children and the community, will develop a vision of education that is derived from the objectives of the State of Israel’s education system. The school staff will then design a *school-based curriculum* [author’s emphasis] (disciplinary or inter-disciplinary) and will accommodate the instructional methods and the learning opportunities to the local circumstances. (p. 7)

It is further stated that

For each school-based curriculum, derived as it is from the official curriculum published by the department of curriculum, the school is permitted to determine the basic concepts, the central contents and the values and skills which the school deems appropriate for its pupils. (p. 7)

The section concludes by stating that

in order to realise autonomy right down to the level of the pupils, the latter should be able to experience a great deal of initiative taking, choice and involvement in planning their learning, as part of an ongoing dialogue with their peers, teachers, parents and other members of the community. (p. 8)

The teacher’s role is described in the document as being ‘proficient in the formal curricula of the Ministry of Education and using them as a source for developing the school-based curricula’ (p. 13). As an organiser of the learning environment the teacher is expected, among other things, to

Involve the pupils in organising the learning environment and planning their time schedule ... to use suggestions and initiatives to deepen and

elaborate on their individual learning topics as well as on the topics that the whole class is working on. (p. 13)

The teacher is also expected to

plan the schedule with a view to an effective use of time, to enable the pupil to act individually and independently as well as in collaboration with peers, to provide students with long term learning opportunities such as individual and joint projects, personal inquiries and initiatives through which s/he promotes perseverance, long term planning, thoroughness, responsibility, etc. (p. 14)

Fulfilling his/her role as an instructor the teacher is expected to 'bring to the pupils' attention the learning strategies that they are employing, to discuss these with the pupils and ask for their motives and intentions' (p. 14). The teacher is also expected to 'promote motivation and encourage the learner to inquire about the world around him/her, to look for what is relevant and to integrate the information in order to achieve cognitive, emotional and social meaning' (p. 14). He/she is also expected

to arouse personal interest, daring, creativity, risk taking and curiosity in his/her pupils, encouraging them by accepting their explorations, creating a relaxed atmosphere, transferring responsibility to them and by showing sympathy and genuine interest. (p. 14)

As a diagnostician and assessor the teacher is expected 'to be responsive to the learner in a way that helps direct his/her further activity and contributes to future decision making'. While promoting his/her professional skills the teacher is expected 'to read and to be acquainted with the formal curricula and decide what should be taken from them for his/her work and what should be adopted as guidelines' (p. 16).

Listed among the characteristics of student learning are the following:

Learning through inquiry processes that take place individually and independently or in collaboration with peers; collaboration in selecting the learning contents and planning the learning environment and the time needed for learning. (p. 16)

Finally, regarding the time schedule, it is stated in the document that

student time is important and it is required to allow time for study in the library, in the laboratory, in special subject rooms and at the computer. Time should also be set aside for guiding pupils in writing their papers and carrying out their projects and individual topics. Pupils should also be allowed time for peer discussion and reading, both for gaining information and for pleasure. (p. 20)

The project reported in this paper was carried out in schools whose education reform efforts were in line with this policy before it was made mandatory. The project focused on the self-directed inquiry process as practised by students in those schools. Our observations led us to identify the following stages in this process: (i)

choosing the domain of interest and defining a topic; (ii) brain-storming (eliciting prior knowledge and generating associations); (iii) generating questions and categories for classifying them; (iv) proposing a key question; (v) planning a relevant study (sources of information, instruments, time schedule); (vi) collecting information and constructing knowledge; (vii) drawing conclusions and giving suggestions for further research; (viii) preparing and editing the final written report; (ix) presenting the findings in class. In the course of the inquiry and at its conclusion the students are required to reflect on the process and to assess their own performance, as well as that of their peers.

Developments in the conceptualisation of mental abilities and learning processes during the last two decades (Gardner, 1983; Sternberg, 1994) have prompted a renewed concern with learner diversity. Noticeable differences have been documented among students in the way they carry out the various learning functions in their studies, even among those who receive the same instruction (Vermunt, 1996). These differences were mainly attributed to students' learning orientations and strategies, which were found to have a crucial effect on learning outcomes (Pintrich *et al.*, 1991). In view of these findings the study of learning approaches and strategies becomes highly important, especially in SDAL contexts.

Over two decades of research has produced a broad literature on learning approaches and strategies. In spite of differences in terminology and in conceptualisation of the sub-components of the constructs, most researchers seem to agree that the broader structure comprises two related constructs: learning strategies and motivation or learning orientations/approaches (Entwistle & Ramsden, 1983; Weinstein *et al.*, 1985; Schmeck *et al.*, 1991; Entwistle *et al.*, 1996; Garcia & Pintrich, 1996). In the present study we have adopted the model of Pintrich and co-workers according to which the learning strategies construct consists of cognitive, metacognitive and resource management strategies and the motivational construct consists of learners' beliefs regarding their ability to perform the task, the value they attribute to the task and their feelings about the task (Pintrich & De Groot, 1990). Joint consideration of these constructs together is suggested by research findings indicating that positive motivational beliefs tend to be associated with greater cognitive engagement in terms of the use of cognitive and metacognitive strategies as well as with improved actual academic performance (Pintrich & Schrauben, 1992).

## **Development of the Assessment Tools**

### *Designing the Questionnaire to Collect Evidence Regarding SDAL*

In order to develop an empirically based multi-dimensional assessment of SDAL an open-ended questionnaire was designed to tap various levels of competence. The questionnaire consisted of two parts: in the first part students were required to plan an inquiry based on a given story addressing an authentic issue. Ten versions of this part were designed and tried out on students in Grades 4 and 6. For example, one version addressed the issue of designing a subway system for Tel Aviv

in order to solve its traffic problems. This authentic issue was used as a prompt. Students were then asked to imagine they were invited to join the research team that was commissioned to investigate the relevant issues related to the subway project. In the items that followed students were asked to list relevant topics to be considered by the research team; to choose one topic and write down their prior knowledge regarding it; to ask questions that they would like to investigate; to classify them; to ask a key question and to evaluate its quality; to describe their plans for the inquiry; to specify the sources of information to be used.

In the second part of the questionnaire students were required to reflect on an inquiry they recently completed. They were asked to specify the topic of the inquiry; to explain why they had selected the topic; to write down the key question; to describe the process of the inquiry; to list the sources of information used; to explain how they organised and synthesised the information gathered; to explain what they learned about the topic and what were their conclusions and their suggestions for implementation and for further research; to explain what had been easy for them in the process and why; to think of one difficulty they had encountered in the process and explain how it was solved; to specify what kind of assistance they had sought and from whom; what they had learned about themselves from working on the project; how they evaluated the end-product; whether they believed they could cope with similar projects in the future and why; how they planned to present the results of the inquiry in class and how they would explain to a friend, who was new to the inquiry process, how to go about it.

Having a two part questionnaire made it possible to collect responses from a large sample for the same questions with minimal disturbance to the ongoing teaching/learning activities. The students were therefore asked not actually to carry out the inquiry they had planned in the first part of the questionnaire. Evidence, retrieved in retrospect, regarding the various stages of the inquiry process was collected in the second part of the questionnaire.

The questionnaires were administered to 453 fourth graders and 443 sixth graders from 26 classes in eight of the schools that participated in the project. The 10 versions of the first part of the questionnaire were randomly assigned in each class. All subjects responded individually to both parts of the questionnaire in class. The results reported in this paper are based on the data from the sample of sixth graders.

### *Developing the Rubric for the Assessment of SDAL*

To assess the levels of competency in the various stages of the inquiry process nine dimensions were defined. Table I lists the dimensions and their descriptions.

Students' answers to the open-ended questions were carefully read by members of the assessment development team who looked for evidence regarding each dimension across the entire questionnaire. Benchmarks defining four levels of competence for each dimension were specified. The lowest level (1) was labelled 'just beginning' and the highest (4) 'reached the goal'. The two intermediate levels (2 and 3) were labelled 'on the way' and 'getting there', respectively. The description of performance at each level was iteratively refined as more questionnaires were read. Each

TABLE I. The dimensions for the assessment of SDAL

Dimension	Description
1. Topic selection	Reasons for selecting the topic and its scope
2. Connection to prior knowledge	Relevancy of the elicited prior knowledge to the given context
3. Questions and their classification	Type of questions, their relevancy to the context and the exhaustiveness and inclusiveness of the classification categories
4. Key question	Type of question and its implications
5. Study plan	Relevancy and variety of resources and tools; sequence of stages specified in the plan
6. Knowledge construction	Evidence regarding organisation and integration of information collected
7. Conclusions	Extent of generalisation of findings; ideas for application; suggestions for further research
8. Reflection and self-assessment	Evidence of metacognitive awareness, accuracy of self-assessment of performance and of self-efficacy
9. Knowledge dissemination	Awareness of audience in the presentation plan

benchmark also included authentic samples of students' responses to the questionnaires. These samples were selected from among responses that we had marked as good illustrations of the different levels of performance.

In the final version of the *Teachers' Guide* (Birenbaum, 1997), space was left for teachers to fill in their comments, interpretations and examples of their students' work. Appendix A presents a complete version (translated from the Hebrew) of one dimension in the rubric as it appears in the *Teachers' Guide*. Because tailoring the rubric to the target population is highly recommended, teachers were also encouraged to develop local rubrics in collaboration with their students. An example of such a rubric, developed by students and their teacher in one of the schools that participated in the project, is included in an appendix to the *Teachers' Guide*.

## The Psychometric Properties of the Assessment

### *Reliability*

The reliability of the assessment of the responses to the questionnaire according to the nine dimensions specified in the rubric was measured by the inter-rater agreement percentage. Two trained assessors (in-service teachers who were taking a seminar on SDAL assessment) each rated the same 20 questionnaires which were randomly selected from the data set. The percentage of agreement between their ratings for each of the nine dimensions ranged from 75 to 90%, indicating an acceptable level of inter-rater agreement.



*Validity*

Evidence for construct validity was gathered with reference to the following aspects, as specified by Messick (1989): content, criterion-related, internal structure. Regarding the content aspect, the rubric and questionnaires were sent for review to four head supervisors of the SDAL programme at the Ministry of Education, who were asked to evaluate the adequacy of the dimensions and the relevance of the questions to the objectives of the programme using a 5 point rating scale (1, not at all satisfactory; 2, not satisfactory; 3, quite satisfactory; 4, satisfactory; 5, very satisfactory). All four reviewers rated the adequacy and appropriateness of the tools as very satisfactory.

To gather evidence regarding the criterion-related aspect of validity two studies were conducted. The first study compared the global ratings of students' SDAL done by their teachers and external raters. The latter (referred to as experts henceforth) were two members of the assessment development team who rated each student after reading the responses to the entire questionnaire. The teachers based their rating on their ongoing interaction with the students. All ratings were given on a 5 point rating scale (where 1 indicated a low level, 3 an intermediate level and 5 a high level of SDAL; levels 2 and 4 were in between ones). Teacher ratings were collected in all participating classes concurrently with student questionnaire administration. Therefore, none of the teachers saw the students' responses or the rubric for assessing SDAL when rating the students. For the purpose of the current study five comparisons were made between teacher and expert ratings. The five classes were randomly selected from the entire sample. The resulting mean comparisons and correlations between the teacher and the expert ratings in each class are presented in Table II, which shows that correlations ranged from 0.25 to 0.75, with a mean correlation of 0.55. All paired *t*-tests for mean comparisons yielded significant results, indicating that expert mean ratings were lower than those of the teachers. A cross-tabulation of teacher and expert ratings indicated that 27 students who were given high ratings by their teachers (level 4 or 5 on the rating scale) were rated two or three levels lower on the same scale by the experts. The number of such students per class ranged from 2 to 13. Their responses to the questionnaires were subjected to a qualitative analysis in order to elucidate the cause of the discrepancy. The following pattern was identified through this analysis: (i) a strong dependence on external authority (quoting the teacher evaluation when asked for a self-assessment; rushing to search for external resources rather than trying first to elicit own knowledge and experience); (ii) transforming rather than constructing knowledge (the research question asks for information readily accessed in reference books and the report is a summary of that information); (iii) achievement rather than learning goals (the main reason for choosing a research question is the availability of sources of information rather than personal interest; the quality of the product seems to be judged on the basis of the amount of time and effort invested and the length of the report); (iv) valuing form over content (in assessing the outcome much importance is attributed to technical and aesthetic aspects of the written report); (v) loose connections between the various aspects of the study (e.g. between prior knowledge

TABLE II. Means, standard deviations, *t* values and Pearson product moment correlations for comparing teacher and expert ratings of SDAL in five classes

Rater	Mean	SD	<i>t</i> value	df	<i>r</i>
Expert	2.83	1.29			
Teacher	3.40	1.31	-3.69 <sup>a</sup>	34	0.75
Expert	3.00	1.00			
Teacher	4.00	1.35	-3.98 <sup>a</sup>	22	0.51
Expert	2.03	0.84			
Teacher	2.52	1.18	-2.80 <sup>b</sup>	30	0.59
Expert	3.30	0.98			
Teacher	3.80	1.20	-2.24 <sup>c</sup>	19	0.59
Expert	2.74	1.24			
Teacher	3.84	1.16	-4.16 <sup>a</sup>	31	0.25

<sup>a</sup>*P* < 0.001.

<sup>b</sup>*P* < 0.01.

<sup>c</sup>*P* < 0.05.

elicited and the research topic, between the research question and type of sources of information used and conclusions drawn).

In the second study teacher and expert holistic ratings of SDAL were each predicted from experts' scoring of the nine dimensions of SDAL. For the purpose of this study five classes were randomly selected from the data set and two trained raters (students in a course on assessment of SDAL) globally rated the level of SDAL reflected in each questionnaire. The scale levels were: 1, just beginning; 2, on the way; 3, getting close; 4, reached the goal. In addition to the holistic rating, the trained raters also used the rubric for scoring each questionnaire with respect to the nine dimensions of SDAL. The results of this analytical scoring were used as predictors of the teachers' holistic ratings in a stepwise multiple regression analysis. The same procedure was repeated to predict the trained raters' holistic scoring. The results of these two analyses are presented in Table III. Table III shows that competency in asking questions and classifying them (D3) and reflection and self-assessment (D8) were the two best predictors of the overall teacher rating of students' SDAL, resulting in a significant analysis accounting for 19% of the variance in the criterion. The same predictors also entered in the first two steps of the analysis predicting the trained raters' overall assessment, followed by five more predictors: knowledge dissemination (D9), prior knowledge (D2), topic selection (D1), research question (D4) and knowledge production (D6), respectively. In this analysis 78% of the variance in the criterion was accounted for by the seven predictors, with the first two accounting for 63%.

The results of the second study also throw light on the internal structure of the dimensions. The intercorrelations among the nine dimensions are presented in Table IV, which shows intercorrelations ranging from 0.01 to 0.51, with a mean of 0.24 (*n* = 126). Figure 1 presents the configuration of the dimensions as points in a two-dimensional space resulting from a MDS analysis. Figure 1 indicates that at the

TABLE III. Stepwise regression results for predicting teacher rating and researcher rating from the nine assessment dimensions ( $n = 126$ )

Step	Variable	$B$	$t$	$R^2$
Teacher rating				
I	QC	0.30	5.54 <sup>a</sup>	0.15 <sup>a</sup>
II	RSA	0.24	2.74 <sup>b</sup>	0.20 <sup>a</sup>
Researcher rating				
I	QC	0.28	4.97 <sup>a</sup>	0.45 <sup>a</sup>
II	RSA	0.28	5.46 <sup>a</sup>	0.63 <sup>a</sup>
III	KD	0.26	5.73 <sup>a</sup>	0.70 <sup>a</sup>
IV	PK	0.20	3.94 <sup>a</sup>	0.74 <sup>a</sup>
V	TS	0.15	3.06 <sup>b</sup>	0.76 <sup>a</sup>
VI	RQ	0.15	2.91 <sup>b</sup>	0.77 <sup>a</sup>
VII	KP	0.12	2.51 <sup>c</sup>	0.78 <sup>a</sup>

CD, conclusion drawing; KD, knowledge dissemination; KP, knowledge production; PK, prior knowledge; QC, question classification; RD, research design; RQ, research question; RSA, reflection and self assessment; TS, topic selection.

<sup>a</sup> $P < 0.001$ .

<sup>b</sup> $P < 0.01$ .

<sup>c</sup> $P < 0.05$ .

core of the inquiry process are reflection (D8) questions and their classification (D3), study plan (D5) and key question (D4). Topic selection (D1) is located further from the centre and the dimensions located the furthest from the centre are those related to knowledge manipulation, i.e. connecting to prior knowledge (D2), knowledge construction (D6), drawing conclusions (D7) and knowledge dissemination (D9).

Evidence regarding the consequential aspect of validity is currently being gathered in a follow-up study in which we are observing the actual usage of the *Teacher's Guide* in schools and its impact on staff professional development, on curriculum planning and on the learning–instruction–assessment process in class.

## Conclusions and Suggestions for Further Study

Evidence collected so far regarding the validity and reliability of the multi-dimensional assessment of SDAL, using the tools provided in the *Teacher's Guide*, is quite satisfactory. The nine empirically defined dimensions specified in the rubrics tap the main sub-processes of self-directed inquiry as it is practised in primary schools that promote self-directed active learners. The questionnaire seems to provide relevant information for the assessment, even though it is not intended to be the sole source of information. Teachers are expected to collect additional evidence in the course of the regular teaching–learning process in class.

The results concerning the reliability of the assessment indicate that when trained raters are using the rubrics a reasonably high level of agreement can be achieved. The comparisons between expert and teacher global ratings of SDAL indicate that

TABLE IV. Correlations among the nine dimensions and with teacher and researcher ratings ( $n = 126$ )

	1 TS	2 PK	3 QC	4 RQ	5 RD	6 KP	7 CD	8 RSA	9 KD	Teacher rating
2 PK	0.21 <sup>c</sup>									
3 QC	0.36 <sup>a</sup>	0.46 <sup>a</sup>								
4 RQ	0.21 <sup>c</sup>	0.37 <sup>a</sup>	0.51 <sup>a</sup>							
5 RD	0.17	0.28 <sup>b</sup>	0.36 <sup>a</sup>	0.36 <sup>a</sup>						
6 KP	0.17	0.04	0.27 <sup>b</sup>	0.16	0.25 <sup>b</sup>					
7 CD	0.17	0.04	0.20 <sup>c</sup>	0.24 <sup>b</sup>	0.15	0.12				
8 RSA	0.26 <sup>b</sup>	0.19 <sup>c</sup>	0.34 <sup>a</sup>	0.37 <sup>a</sup>	0.26 <sup>b</sup>	0.44 <sup>a</sup>	0.35 <sup>a</sup>			
9 KD	0.25 <sup>b</sup>	0.01	0.16	0.21 <sup>*</sup>	0.23 <sup>*</sup>	0.10	0.18	0.22 <sup>c</sup>		
Teacher rating	0.24 <sup>b</sup>	0.26 <sup>b</sup>	0.39 <sup>a</sup>	0.36 <sup>a</sup>	0.21 <sup>c</sup>	0.16	0.28 <sup>b</sup>	0.34 <sup>a</sup>	0.25 <sup>b</sup>	
Researcher rating	0.48 <sup>a</sup>	0.48 <sup>a</sup>	0.67 <sup>a</sup>	0.58 <sup>a</sup>	0.47 <sup>a</sup>	0.40 <sup>a</sup>	0.35 <sup>a</sup>	0.62 <sup>a</sup>	0.45 <sup>a</sup>	0.51 <sup>a</sup>

1 TS, topic selection; 2 PK, prior knowledge; 3 QC, question classification; 4 RQ, research question; 5 RD, research design; 6 KP, knowledge production;

7 CD, conclusion drawing; 8 RSA, reflection and self assessment; 9 KD, knowledge dissemination.

<sup>a</sup> $P < 0.001$ .

<sup>b</sup> $P < 0.01$ .

<sup>c</sup> $P < 0.05$ .

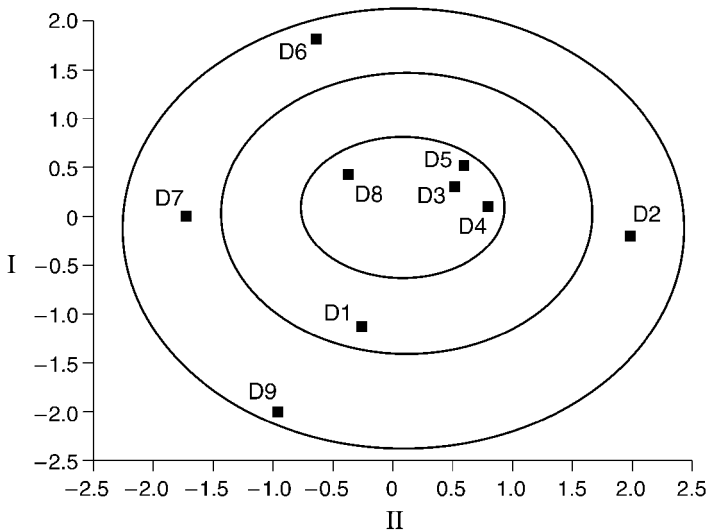


FIG. 1. Configuration of the nine assessment dimensions in a two-dimensional space. D1, topic selection (TS); D2, prior knowledge (PK); D3, question classification (QC); D4, research question (RQ); D5, research design (RD); D6, knowledge production (KP); D7, conclusion drawing (CD); D8, reflection and self-assessment (RSA); D9, knowledge dissemination (KD).

teachers differ among themselves in their perception of the requisite competencies for SDAL. Although we did not directly measure teachers' perception in this regard, we can infer from our qualitative analysis of responses to the questionnaire given by students highly rated by their teachers and substantially lower by experts that these teachers' beliefs about knowledge and knowing resemble Perry's (1970) description of a primitive dualistic conception which is marked by the belief that authorities are expected to know the truth and to convey it to the learners (Hofer & Pintrich, 1997). Further research should examine teachers' perceptions of SDAL in more detail and compare the amount of variance in students' SDAL scores explained by school context/culture with that explained by individual differences among teachers.

The dimensions which turned out to be the best predictors of overall SDAL rating in our analysis were question generating and classifying, and reflection and self-assessment which, subsequent to multidimensional scaling analysis, were also mapped at the core of the configuration representing the relationships among the dimensions. Generating questions is a skill more often associated with teachers than with students (Goodlad, 1984). Classification, in turn, requires higher order thinking skills, e.g. analysis, comparison, finding a common denominator and generalisation. Reflection is at the core of mindful and meaningful learning and its importance in directing one's thoughts is well acknowledged (Vygotsky, 1962). Both reflection and self-assessment are essential indicators of the metacognitive awareness and control that are required of self-directed active learners.

### *Possible Uses of the Teacher's Guide*

The *Teacher's Guide* can be used in various ways and for various needs. It is mainly a learning tool for promoting teachers' professional development with respect to SDAL. For teachers who have already run such a programme the guide is intended to improve their diagnostic competencies so they can design relevant interventions. Teachers who are just introducing the SDAL programme in their classes can use the *Teacher's Guide* as part of their exposure to the topic. Students can use a version of the rubric that is targeted at their level of understanding to get a better idea of where they are and where they are headed as they carry out their inquiries. As mentioned above, teachers and students should collaborate in developing their own rubrics to suit their specific instructional and learning needs. Parents too can use the rubrics in order to gain insight into their child's accomplishments and competencies as a self-directed active learner.

### *Current Usage of the Teacher's Guide*

The *Teacher's Guide* is currently being distributed by the Ministry of Education to primary schools which are in various stages of implementing active learning programmes. In schools which already practice the inquiry method the *Teacher's Guide* is used for formative assessment purposes. Several schools are currently developing local rubrics in collaboration with their students to be used for student self-assessment. Other schools use the rubrics to communicate to parents their children's profile as self-directed learners. For schools which are in the first stages of implementing active learning through inquiry the *Teacher's Guide* serves as learning material in professional workshops on SDAL.

### *Suggestions for Further Study*

Based on the experience we gained in developing the assessment tools and given the evidence we have collected so far regarding the reliability and validity of the assessment, we have formulated the following topics for further study: (i) students' and teachers' perceptions of SDAL; (ii) the relationships between student SDAL profiles and their teacher's beliefs about knowledge and ways of acquiring it; (iii) actual use of the *Teacher's Guide* in various educational contexts; (iv) to what extent do teachers themselves develop new tools for assessing SDAL and/or add their ideas and experiences to the existing version of the *Teacher's Guide*?; (v) how do teachers assess learning outcomes, i.e. do they only assess the quality of the products or do they also refer to the learning processes and the quality of the instruction?

### **Acknowledgements**

The author would like to thank her two assistants in this project, Lisa Amdur and Sara Katz, for their help in the various stages of the development of the assessment tools and her students, Michal Shemesh, Lea Levi, Keren Fridman and Zehava

Apple, for their assistance in analysing the results reported in this paper. The project reported in the paper was commissioned and sponsored by the Israeli Ministry of Education under contract no. MI-000203-95-6.

## NOTE

[1] A mandatory document that is distributed to all schools.

## REFERENCES

- BIRENBAUM, M. (1997) *Teacher's Guide for Mapping and Assessing Self Directed Active Learning by Investigating* (Jerusalem, Ministry of Education, Culture and Sport) [in Hebrew].
- CORNISH, E. (1986) Educating children for the 21st century, *Curriculum Review*, 25 (4), pp. 12-17.
- ENTWISTLE, N. & RAMSDEN, P. (1983) *Understanding Students Learning* (London, Croom Helm).
- ENTWISTLE, N., TAIT, H. & SPETH, C. (1996) Identifying and advising students with deficient study skills: an integrated computer-based package for staff and students, in: M. BIRENBAUM & F. J. R. C. DOCHY (Eds.) *Alternatives in Assessment of Achievement, Learning Processes and Prior Knowledge*, pp. 365-380 (Boston, MA, Kluwer.)
- GARCIA, T. & PINTRICH, P. R. (1996) Assessing students' motivation and learning strategies in the classroom context: the motivated strategies for learning questionnaire, in: M. BIRENBAUM & F. J. R. C. DOCHY (Eds.) *Alternatives in Assessment of Achievement, Learning Processes and Prior Knowledge*, pp. 319-339 (Boston, MA, Kluwer).
- GARDNER, H. (1983) *Frames of Mind* (New York, NY, Basic Books).
- GOODLAD, J. (1984) *A Place Called School* (New York, NY, McGraw-Hill).
- GRENNON BROOKS, J. & BROOKS, M. G. (1993) *In Search of Understanding: the case for constructivist classrooms* (Alexandria, VA, Association for Supervision and Curriculum Development).
- HOFER, B. & PINTRICH, P. (1997) The development of epistemological theories: beliefs about knowledge and knowing and their relation to learning, *Review of Educational Research*, 67 (1), pp. 88-140.
- LANGER, E. J. (1989) *Mindfulness* (Reading, MA, Addison-Wesley).
- LANGER, E. J. (1993) A mindful education, *Educational Psychologist*, 28 (1), pp. 43-50.
- LONKA, K. & LINDBLOM-YLÄNNE, S. (1996) Epistemologies, conceptions of learning, and study practices in medicine and psychology, *Higher Education*, 31 (1), pp. 5-24.
- MESSICK, S. (1989) Validity, in: R. L. LINN (Ed.) *Educational Assessment*, 3rd edition, pp. 13-103 (Englewood Cliffs, NJ, Prentice Hall).
- MINISTRY OF EDUCATION (2000) *Director General's Policy Guidelines 2000/7 (b)* (Jerusalem, Ministry of Education) [in Hebrew].
- NEWMANN, F. M. & WEHLAGE, G. G. (1993) Five standards of authentic instruction, *Educational Leadership*, 50 (7), pp. 8-12.
- PERRY, W. G. (1970) *Forms of Intellectual and Ethical Development in the College Years: a scheme* (New York, NY, Holt, Rinehart & Winston).
- PERKINS, D. N. (1992) *Smart Schools—from training memories to training minds* (New York, NY, The Free Press).
- PINTRICH, P. R. (2000) The role of orientation in self-regulated learning, in: M. BOEKAERTS, PINTRICH, P. R. & ZEIDNER, M. (Eds.) *Handbook of Self-regulation*, pp. 451-502 (San Diego, CA, Academic Press).
- PINTRICH, P. R. & DE GROOT, E. V. (1990) Motivational and self-regulated learning components of classroom academic performance, *Journal of Education Psychology*, 82, pp. 33-40.
- PINTRICH, P. R. & SCHRAUBEN, B. (1992) Students' motivational beliefs and their cognitive engagement in classroom academic tasks, in: D. H. SCHUNK & J. MEECE (Eds.) *Students' Perceptions in the Classroom*, pp. 149-183 (Hillsdale, NJ, Erlbaum).

- PINTRICH, P. R., SMITH, D. A. F., GARCIA, T. & MCKEACHIE, W. J. (1991) *A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ)* (Ann Arbor, MI, National Center for Research to Improve Postsecondary Teaching and Learning).
- RANDI, J. & CORNO, L. (2000) Teacher innovations in self-regulated learning, in: M. BOEKAERTS, PINTRICH, P. R. & ZEIDNER, M. (Eds.) *Handbook of Self-regulation*, pp. 651–685 (San Diego, CA, Academic Press).
- RESNICK, L. B. (1987) Learning in school and out, *Educational Researcher*, 16 (19), pp. 13–20.
- RESNICK, L. B. & KLOPFER, L. E. (Eds.) (1989) *Toward the Thinking Curriculum: current cognitive research* (Alexandria, VA, Association for Supervision and Curriculum Development).
- SCHMECK, R. R., GEISLER-BRENSTEIN, E. & CARCY, S. P. (1991) Self-concept and learning: the revised inventory of learning processes, *Educational Psychology*, 11, pp. 343–352.
- SCHUNK, D. H. & ERTMER, P. (2000) Self-regulation and academic learning, in: M. BOEKAERTS, PINTRICH, P. R. & ZEIDNER, M. (Eds.) *Handbook of Self-regulation*, pp. 631–649 (San Diego, CA, Academic Press).
- SIZER, T. R. (1992) *Horace's School. Redesigning the American high school* (Boston, MA, Houghton Mifflin).
- SIZER, T. R. (1996) *Horace's Hope. What works for the American high school* (Boston, MA, Houghton Mifflin).
- STERNBERG, R. J. (1994) The triarchic theory of human intelligence, in: R. J. STERNBERG (Ed.) *Encyclopaedia of Human Intelligence*, (Vol. 2), pp. 1087–1091 (New York, NY, Macmillan).
- STATE OF ISRAEL MINISTRY OF EDUCATION, CULTURE AND SPORT (1998) *Facts and Figures about Education and Culture in Israel* (Jerusalem, Ministry of Education Culture and Sport).
- VERMUNT, D. J. (1996) Metacognitive, cognitive and affective aspects of learning styles and strategies: a phenomenographic analysis, *Higher Education*, 31 (1), pp. 25–50.
- VYGOTSKY, L. (1962) *Language and Thought* (Boston, MA, MIT Press).
- WEINSTEIN, C. E., ZIMMERMANN, S. A. & PALMER, D. R. (1985) College and university students' study skills in the U.S.A: the LASSI, in: G. D'YDEWALLE (Ed.) *Cognition, Information Processing, and Motivation*, pp. 703–726 (Amsterdam, Elsevier Science Publishing).
- ZIMMERMAN, B. J. (1989) Models of self-regulated learning and academic achievement, in: B. K. ZIMMERMAN & D. H. SCHUNK (Eds.) *Self Regulated Learning and Academic Achievement: theory, research, and practice*, pp. 1–25 (New York, NY, Springer-Verlag).



APPENDIX A

DIMENSION 7: **DRAWING CONCLUSIONS**

**A. Conclusions regarding the research question (extent of generalisation, recommendations and suggestions for further research.)**

**B. Conclusions regarding performing the study (based on the student's suggestions to novices)**

**Just beginning**

- A. No conclusion stated or the conclusion is not related to the results, or information learned is provided as the conclusion.  
No response regarding what has been learned from the study.  
No suggestions for further research.
  - B. No concrete suggestions for improving study skills but rather suggestions to invest more effort or ask the teacher.
- 

Examples

- A. Conclusion (Topic: 'Jerusalem'): *My conclusion was when Jerusalem was founded, how it looks, how old it is, why it is called Jerusalem.*  
Suggestions for further research: *using work sheets prepared by the teacher*  
*- I researched all there is to study.*
  - B. Guiding novices: *I would suggest he go ask the teacher.*  
*- To go to his teacher and ask how to do it and to get help from parents.*
- 
- 
- 
- 
- 
-

**On the way**

- A. No statement of a conclusion that came out of the study or the conclusion is not based on the results of the study.  
Only technical suggestions are given (e.g., to refer to additional sources of the same kind that were used in the study).
- B. Guiding novices: a partial vague list of the research stages and/or a general statement.

---

---

---

Examples

- A. Conclusion: (the research question was: Which eras were there in Jerusalem?) *My conclusion was that the Temple Mount borders the Wailing Wall and that Jerusalem has eight gates.*  
Suggestions for further study: *To continue researching the topic in additional books.*
- B. Guiding novices: *I would suggest to him: 1) to write down questions regarding the topic he chose; 2) to find the answers in informative sources; 3) to write a draft; 4) to write in a folder; and 5) to hand it in.*

---

---

---

---

---

---

**Getting close**

- A. A conclusion is stated but most often it does not relate to the research question.  
One or more things that were learned are mentioned.  
Relevant suggestions for further study relating to using other kinds of sources in order to support the results.  
Suggestions for application are given but they are not explained.
- B. Guiding novices: a list of the research stages without personal lessons.

Examples:

- A. What the student has learnt (the topic: Chanuka): *What are the three blessings that are made on the Chanukiya. How many candles are there. who lights them, what does the Chanukiya look like and why.*  
Suggestions for further research (a paper on Golda Meir): *I would interview her relatives.*  
(A paper about the clock) : *I would take a few clocks and disassemble them and then I would write about their differences.*  
Recommendations: (the topic: road accidents): *I suggested putting speed traps on the highways and at various intersections.*
- B. Guiding novices: *I would suggest he brain-storm, write questions, classify them collect sources of information, prepare a concept map, 'write the paper according to that map, do a summary and bibliography. At the end I would tell him that the work should be aesthetic and neat.*
- 
- 
- 
- 
- 
- 
- 

**Reached the goal**

- A. The conclusion is related to the research question.  
Logical connections and one or more generalised conclusions that are related to the research question.  
Generalisations regarding the new things that were learnt as a result of the study.  
Personal implications drawn from the process.  
Relevant suggestions for further research from a different perspective.  
Reasoned suggestions for application.
- B. Guiding novices: all research stages are mentioned. Emphasis is placed on interest in the study and personal lessons.

Examples:

A. Conclusions: (the topic: Hearing Impaired Children): *The conclusion was that hearing impaired children are like all other children.*

(Topic: The Development of the Transportation in the North of the State): *The conclusion is that the developing transportation contributed to the quality of life of many people. I would suggest to continue studying the negative effect of transportation on the quality of life.*

(Topic: Child Abuse): *My conclusion is that the parents when they were young were themselves abused by their parents.*

(Topic: Rabin): *I have learned about all that Rabin has contributed to our country and also what each of his relatives felt and still feels about him and I too renewed my feelings toward him.*

(Topic: Ruth the Moabite): *My conclusion is that Ruth is a good model for decency and adherence to a goal.*

Recommendations and Suggestions for application (topic: animal abuse): *There is a need to continue fighting this phenomenon. Maybe the following suggested actions can be adopted: 1) collect stray cats from around in the country to special places where they would be taken care of, their health would be taken care of and they would be provided with food and water. There the cats would find a home because they would be attached to the place and in that way the number of stray cats would be reduced and so would the dirt in the city; 2) advertise the adoption of pets - the benefits and contribution; 3) Publicise cases of animal abuse on street signs, on bulletins and in the daily press, in order to encourage awareness of things that are being done and in this way encourage the willingness to fight this horrible phenomenon.*

Suggestions for further research (topic: Rabies): *My suggestion is to thoroughly study the people who researched rabies. What is the vaccination composed of etc.*

B. Guiding novices: *I would suggest to imagine, to chose a topic that especially interests him because only in that way could he have fun working. Then to read a little bit about the topic and visit places that are related to the topic, to talk to people who know the topic and only then start working as he gets interested.*

*- I suggest he do the stage I did, not to feel pressured, to keep cool not to be scatterbrained to get organised and most important to enjoy his work.*

*- I suggest he first think about a topic that most interests him and when he finds one to ask a lot of questions regarding it and then to organise everything and classify it into subtopics, organise the chapters so that they are in the right order and to make connections, and then go to the library or to another place and find books or other sources regarding his topic, to start mixing and summarising the material' till one*

chapter after the other comes out... to number the pages, to write a list of contents that tells what there is and where and an introduction and a bibliography.

- I would suggest he keep an open mind and not rely only on encyclopaedias and invest the maximum and enrich the work.

- I would suggest he find a topic that interests him and then write questions about it, then look for sources of information to skim through them, then I would tell him to find chapter headers and start summarising. I would also tell him to write at the beginning what he is going to write about in the paper and in the final part, what he thinks about his paper, and finally I would tell him to write a bibliography and also at the beginning to find as many sources of information as possible.

---

---

---

---

---

---

---