

PATHWAYS OF LEARNING IN VOCATIONAL AND PERSONAL DEVELOPMENT

Part II: Some results of systematic development in workshops for handicapped people

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This paper presents an account of work with the "Pathways Model", which is a curriculum for the "Work Training Programme" in the German "Workshops for Handicapped People". Their work and the concepts underlying their approach have been described in Part I of this paper (Brackhane, 1994) and elsewhere (Brackhane, 1990a, 1990b). Here we will now present some examples from daily work to illustrate the approach and some results of the ensuing development.

Assessments

In the "Workshop for Handicapped People" (Werkstatt für Behinderte) of the Lebenshilfe Detmold e.V. psychological testing methods have been used for nearly fifteen years for the assessment of every newly admitted handicapped trainee. On the basis of the results recommendations can be made

for their occupational training. The results can also be used as a means of checking the efficacy of the "Pathways Model", because they represent objective, independent, external assessments. Several non-verbal intelligence and aptitude tests are used (TABLE I).

It takes about 2 to 4 hours per person to carry out an assessment, usually spread over two sittings.

Investigation I

In the following we will report on a study which we carried out in 1989 with 29 persons (Sample I) as part of checking progress at the workshops. The trainees had all been tested at admission at the age (CA I) of 19-20. They had subsequently passed through the "work training programme" which used the "Pathways Model" for systematic developmental work. At the time of the second test the trainees were 22-29 years

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TABLE I
Intelligence and Aptitude Tests used in the "Work Training Programme"

Snijders, J. T. and Snijders-Oomen, N. (1958). Nichtverbale Intelligenzuntersuchung für Hörende und Taube. Groningen. [Assesses aspects such as memory (SON-G), analogies (SON-A), combination (SON-K), reasoning (SON-M)].

Zifer, H. (1973). Mann-Zeichen-Test (MZT). Münster. [The tested person has to draw a man, the number of details is to be interpreted].

Raven, J. C. (1978). Coloured Progressive Matrices (RPM - German adaptation by A. Schmidtke *et al.*, Weinheim. [Missing parts in geometrical patterns have to be completed].

Schmale, H. and Schmidtke, H. (1966). Berufs-Eignungs-Test (BET). Bern [Assesses aspects such as dexterity, manual skill: subtests BET-9, BET-10, BET-11 and BET-12].

Bondy, C., Cohen, R., Eggert, D. and Luer, G. (1971). Testbatterie für geistig behinderte Kinder (TBGB). Weinheim. [Subtest "Kreise punktieren" (KP)].

TABLE II
Personal details of Sample I at first (I) and second (II) test

Subj.	Sex	CA I	CA II	MA I	MA II	Work Area
R.B.	m	19	22	8,50	10	fruit growing
K.B.	f	20	24	6,75	9	laundry
W.C.	m	19	25	8	5	joinery
S.D.	f	20	26	3,50	4	indust. ass.
H.D.	m	19	24	8	12,25	fruit growing
U.G.	f	19	23	3,50	3,75	indust. ass.
S.H.	f	20	24	4,50	5,50	indust. ass.
M.K.	m	19	26	5,25	5,75	kitchen
S.K.	f	19	23	12,50	12	sewing
M.K.	f	19	25	6,50	9	laundry
M.M.	f	20	29	4,50	5,25	laundry
A.M.	f	19	27	5,75	7	cleaning
M.M.	m	19	27	4,25	5	indust. ass.
H.M.	m	20	25	5,25	5,75	joinery
R.P.	f	19	23	6,25	8	kitchen
A.P.	f	20	24	5	5,25	indust. ass.
C.P.	f	20	28	4,50	5,50	laundry
H.R.	m	19	26	5,50	6,25	indust. ass.
T.S.	m	20	23	8,50	8,50	kitchen
B.S.	m	19	26	11,50	9	fruit growing
E.S.	f	20	23	4,25	4	indust. ass.
F.S.	m	19	27	4,75	5,50	indust. ass.
D.S.	m	19	23	9,50	10,25	fruit growing
T.S.	m	20	25	4,75	7,00	indust. ass.
P.S.	f	20	26	5	5,50	indust. ass.
J.T.	m	19	28	12	13	joinery
U.W.	f	20	25	9	10,75	kitchen
G.W.	f	19	27	9	11,50	cleaning
K.W.	m	19	25	5,25	6	indust. ass.

old (CA II) and had been working - some for several years - in various areas such as "industrial assembly", "kitchen", "laundry", "fruit-growing" and "joinery" (TABLE II).

In general, we can record that the overall picture shows clear improvements in mental age (MA I/MA II) and this suggests that mentally handicapped people between the ages of 20 to 30 have a development potential that can be tapped.

The details of the two assessments using the tests outlined in TABLE I are given in TABLE III.

The evaluation showed statistically significant improvements in some areas (SON-M, SON-G, SON-A, BET-9, BET-10), no changes in others (SON-K, MZT, RAVEN, BET-12, KP) and only in one

area significant deterioration (BET-11). The group was older (CA) on average by almost 5 years and the average mental age (MA) had increased from 6.55 years to 7.43 - that is nearly one year.

Sex, age and areas of work could also affect results. TABLE IV showing the average chronological and mental ages indicates that men and women are quite comparable as far as age is concerned. On the other hand the average mental age of women is at a lower level than that of men at the beginning but women add comparatively more gains than men when tested second time.

The area of work may affect the degree of improvement but the number of cases is too small to do more than point out some tendencies. For example TABLE V.

TABLE III
Test results at first and second assessment of Sample I (N=29)

Procedure:		1st test	2nd test	Diff.	p	
<i>Mental Ages</i>		6,55	7,43	0.88	.001	sign
<i>Non-Verbal Intelligence Subscores</i>						
	SON-M	9.42	12.17	2.72	.002	sign
	SON-G	9.10	10.55	1.45	.005	sign
	SON-K	8.97	10.17	1.20	.053	/
	SON-A	7.41	8.66	1.25	.007	sign
	MZT	15.76	16.41	0.65	.396	/
	RAVEN	20.33	21.26	0.93	.292	/
<i>Psychomotor Subscores:</i>						
	BET 9	43.93	48.35	4.42	.046	sign
	BET 10	45.76	52.35	6.59	.012	sign
	BET 11	11.48	9.04	-2.26	.016	sign
	BET 12	12.11	10.86	-0.75	.298	/
	KP	76.21	75.28	-0.93	.846	/
<i>Intelligence Age</i>		6.55	7.43	0.88	.001	sign

TABLE IV
Sex differences in chronological and mental ages (N=29)

			1st assessment	2nd assessment	Difference
AGE	WOMEN	N = 15	19.6	25.1	5.5
	MEN	N = 14	19.2	25.1	5.9
	Difference		0.4	0	
M.A.	WOMEN	N = 15	6.00	7.05	1.05
	MEN	N = 14	7.20	7.80	0.60
	Difference		1.20	0.75	

TABLE V
Areas of work and gender in relation to improvement

	Number and Sex	Mean of mental ages: Improvement
Indust. Ass.	N=11 (5 M, 6 F)	from 4.75 to 5.25
Laundry	N=4 (4 F)	from 5.50 to 7.10
Kitchen	N=4 (2 M, 2 F)	from 7.40 to 8.25
Fruit Grow.	N=4 (4 M)	stay on 10.1

TABLE VI
Changes in mental age scores (N = 29)

Intelligence	1st assessment MA I		2nd assessment MA II		Diff.
	Range	Median	Range	Median	
"Low"	3.50 - 5.25	4.6	3.75 - 7.00	5.2	0.6
"High"	5.50 - 12.50	8.6	6.25 - 13.00	9.7	1.1
Difference		4.0		4.5	

It may well be that the initial selection for work areas may have been influenced by the demonstrated intellectual level and that subsequent improvement might be associated with a higher mental potential at the beginning. A grouping on the basis of the median in mental age in the first assessment (5.25%) results in a low (3.50 to 5.25) and a high intelligence group (5.50 to 12.50). The differences of changes

in mental age scores at the second assessment are suggestive (TABLE VI).

The "low intelligence group" shows an improvement in mental age from 4.6 to 5.2 years - that is a difference of 0.6 intelligence years on average, whereas the "high intelligence group" shows improvements on the second test from 8.6 to 9.7 years - that is a difference of 1.1 intelligence years on average.

This difference is particularly noticeable among the fifteen women who show an improvement of nearly 2 years (1.93) between the two assessments (TABLE VII).

On the other hand men in the "low intelligent" group and men in the "high intelligent" group do not much differ in their improvements (.78 respectively .67).

These results of changes in mental ages could be augmented and checked by analysis of all tests employed. Since this was an operational research and various control measures were not applied, in particular regarding the role of the "Pathways Model", sophisticated statistical treatment was not indicated. Nevertheless the results appear to demonstrate the significance and usefulness of further and more exhaustive investigations and they can also support the thesis that, within the framework of the "Pathways Model", psychodiagnostic methods can be productively used as a development control. The training programme based on the "Pathways Model" initiates a fruitful development process which was explored in greater detail in further research - as described in the following second investigation.

Investigation II

We will here compare the results of surveys of the learning objectives already reached at the beginning and those achieved at the end of the work training programme.

Data from another random sample of 18 persons (Sample II) who completed the work training programme in 1990/91 will serve as a basis. The first survey was carried out in 9-11 months after the start of the work training programme (I), and a second survey from about 6 months thereafter (II). Finally, a third survey (III) was undertaken from about 6 months after the second survey when only 11 people were left in the training programme. Progress is recorded in TABLE VIII.

TABLE VIII demonstrates the improvements between the first and second survey particularly in the area of cognitive learning objectives - and also in the acquisition of social competence. Here it becomes very obvious that the "Pathways Model" is not only concerned with occupational training, but also, to a high degree, with the development of the personality of the handicapped trainee.

TABLE VII
Improvements in Mental Ages Scores

	Intelligence Group		Difference
	"Low"	"High"	
WOMEN	.22 N = 8	1.93 N = 7	1.71
MEN	.78 N = 7	.67 N = 7	0.11
Difference	.56	1.26	

TABLE VIII
Learning Objectives achieved by Sample II

	Survey I (N=18)	Survey II (N=18)	Survey III (N=11)
Range of Cognitive Learning Objectives	4% - 72%	18% - 93%	23% - 88%
Median	30,5%	46,5%	38%
Range of Psychomotor Learning Objectives	8% - 80%	30% - 86%	40% - 84%
Median	55%	61,5%	59%
Range of Social Learning Objectives	14% - 73%	18% - 86%	20% - 64%
Median	32%	42,5%	44%

Data of the third survey (N=11) seem to suggest standstill or even steps backward in development, but on closer analysis this proves not to be the case. The 11 people of the original sample of 18 were all "left overs", from the "weaker half" of the sample and had been permitted to take part on a prolongation of the work training programme - but the "stronger" and "fitter" ones had already been taken into the work area of the workshops.

This means that the "Pathways Model" is actually in a position to give information about individual development and can thereby serve as a basis for further planning and for a person's further life.

The Precondition-Cluster-Analysis

By means of the Precondition-Cluster-Analysis or VCA (Voraussetzungs-Cluster-Analyse, Kleiter, 1974, 1988,

Kleiter and Petermann, 1977) we are also able to depict - using the difficulty index described below - which learning objectives are of particular significance for occupational and personal development. The VCA can give hints not only about the statistical coherence ("correlation") of two items, but even about the kind of coherence, i.e. which item in a relationship of two is preliminary and which is consecutive.

The "Index of Difficulty" is a measure of the proportion of observed cases, related to the possible. It is 100 (%), if no one can solve the tasks, and 0 (%) if all trainees can. If 80 from 100 people can solve a problem (difficulty index = 20), this task has a lower difficulty as if only 35 from 100 can solve it (difficulty index = 65).

So this index indicates in a simple way, how difficult the learning objectives are in regard to the trainees. For example, in Sample II (N=18) the index for the 16 selected **psychomotor learning objectives** is reduced from 14.5

points to 5 points - i.e. these objectives are easy to manage already in the first survey (14.5) and no problem at all in the second (5).

The 35 **cognitive learning steps** in this investigation are reduced in the same sample from 38 to 19 points - i.e. an evident improvement, also shown in the case of the 44 social learning objectives with a reduction from 48.5 to 27 points between the two surveys: in the first survey about half of the people could manage the steps, in the second already about three quarters - only 27% are not yet able. This analysis indicates that the psychomotor learning objectives had, for the most part, already been achieved by the persons of this sample

at the beginning of their work training programme, whereas in the case of the cognitive and social learning objectives, great progress has been made from a relatively low initial standard.

We will illustrate the results of a cluster analysis by reference to the 35 cognitive steps already mentioned in the last paragraph which occur in the cases of the 18 tested people discussed in the preceding section. TABLE IX lists the learning steps which the first learning objectives survey indicated as being particularly fundamental. TABLE X lists which learning steps are in the initial phase particularly difficult, i.e. only attainable by means of other learning objectives.

TABLE IX
Particularly fundamental Learning Steps

<p>Knows simple cause-reaction correlations for his area of work (e.g. light switch - light; thermostat - heating; tap - water). (Code K 1.51/1).</p> <p>Can say what he has to do to bring about a certain effect (e.g. when I press the light switch, the light goes on or off). (Code K 1.51/2).</p> <p>Can select objects that have been named and pointed out just before from various typical items/materials from his working area. (Code K 1.61/1).</p> <p>Can retain simple verbal instructions for several minutes and then act on them. (Code K 1.61/2).</p> <p>Can point out the tools in his working area which are used for very exact or fine work. (Code K 2.01/1).</p> <p>Can correctly assign these precision tools to their corresponding working material. (Code K 2.01/2).</p> <p>Knows the prescribed method of work for partial steps of his work. (Code K 4.29/1).</p>
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TABLE X
Particularly difficult Learning Steps

<p>Can draw conclusions (e.g. if A is larger than B and B is larger than C, then A is also larger than C). (Code K 1.51/5).</p> <p>Can also make more complex decisions at his place of work (e.g. sorting of laundry; selection of tools). (Code K 1.52/3).</p> <p>Can name or show, in the case of several working steps, the partial steps where special care must be paid to quality while carrying them out (e.g. measuring; special soldering tasks). (Code K 4.32/4) - and especially</p> <p>Can pass on more extensive information to different corresponding responsible posts. (Code K 1.61/5).</p>

At least in theory, indications of lateral connections between different learning objective sequences can be derived from the mathematical model of the VCA; these illustrate not only simple difficulty gradations, but also a network of individual learning steps. At present, the practical application of this model is being tested - in this manner concepts and "ways of learning" which are valuable for the furtherance of variously handicapped people will ensue.

This also includes the formation of "functional clusters". They could, for example, beyond mere pedagogical considerations, give information about the relationship of content between different learning objectives and learning objective sequences and could thereby open new perspectives. Such a cluster is (mathematically) formed, for example,

from the *cognitive* learning steps in accordance with the results of the first learning objective survey (TABLE XI).

By analogy, there is a functional cluster among the *psychomotor* learning objectives (TABLE XII).

These clusters can change in the learning process, i.e. can be restructured with increasing competence in a skill.

Concluding Remarks

The two parts of this paper demonstrate the possibilities of using the "Pathways Model" for supervising and optimising daily work in the vocational and personal development of handicapped people. We are aware that we can only draw tentative conclusions. They suggest that there are scientifically

TABLE XI
Example of Cluster among Cognitive Learning Steps

<p>Can say what he has to do to bring about a certain effect (e.g. when I press the light switch, the light goes on or off). (Code K 1.51/2).</p> <p>Can select objects that have been named and pointed out just before from various typical items/materials from his area of work. (Code K 1.61/1).</p> <p>Can retain simple verbal instructions for several minutes and then act on them. (Code K 1.61/2).</p> <p>Knows the handle and functional parts of various simple tools and can name or show these parts on his tools. (Code K 2.02/2).</p>
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TABLE XII
Example of Cluster among Psychomotor Learning Objectives

<p>Can hold the usual simple tools of his work area in the proper manner (e.g. knife: blade facing down). (Code P 2.02/2).</p> <p>Can perform the typical movements for simple tools (e.g. scissors: cutting motion; hammer: raising and lowering motion). (Code P 2.02/3).</p> <p>Can follow the movements of both hands or feet with his eyes. (Code P 2.49/1).</p> <p>Can draw a line pre-drawn by finger. (Code P 2.49/3).</p>
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based concepts for the development of handicapped people, and that working with these concepts facilitates and improves daily practice.

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