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ORIGINAL ARTICLE

Peritoneal dialysis training performed remotely: results and comparison with Home Training

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Abstract

Objectives Traditional training (Home Training) in peritoneal dialysis (PD) is based on the physical presence of nurse and patient/caregiver. These "space–time" constraints can influence the training's duration, methodology and results. A remote caregiving system (Videodialysis) in our Center has proved to be effective and safe in remotely guiding patients/caregivers with cognitive/psychological barriers to self-care-PD. Since 08/01/2016, to overcome the limitations of Home Training, Videodialysis has also been used to carry out remote patients/caregivers training (Video Training). Retrospective comparison between Video Training (08/01/2016–05/31/2020) and Home Training (01/01/2014–07/31/2016).

Methods Following initial home-visit Video Training is performed via telemedicine from the Center, whereas Home Training is carried out at the patient's home. Only first trainings for all incident PD patients/caregivers were considered. The following patients were excluded: 9 in nursing homes, 13 kept on Videodialysis due to barriers to self-care, 6 uncompleted procedures, 4 other. Total duration, home visits, exchanges/procedures, peritonitis, technique survival were compared between Home Training and Video Training.

Results 46 trainings were considered (median; IQR): 21 Home Training (CAPD/APD: 11/10) in 17 patients (74.3 years (58.8–78.0; assisted PD: 64.7%) and 25 Video Training (CAPD/APD: 8/17) in 21 patients (65.9 years (56.9–76.4) N.S.; assisted PD: 52.4%). *Duration (days)*: Home Training: CAPD 4.0 (4.0–5.5); APD 8.0 (5.3–10.5); Video Training: CAPD 4.5 (3.8–5.0) (N.S.); APD 8.0 (6.0–13.0) (N.S.). *Home-visit (number)*: Home Training: CAPD 9.0 (7.0–10.0); APD 11.0 (7.8–15.5); Video Training: CAPD 2.0 (2.0–3.5) ($p < 0.001$); APD 5.0 (4.0–6.0) ($p < 0.001$). *Peritonitis (episodes)*: Home Training: 5 (Follow-up: 471 pts/months); Video Training: 0 (Follow-up 280 pts/months). 2-Year technique survival. Home Training: 56.3%; Video Training: 76.9% (N.S.).

Conclusions Video Training is as effective as Home Training, while significantly reducing the number of home visits.

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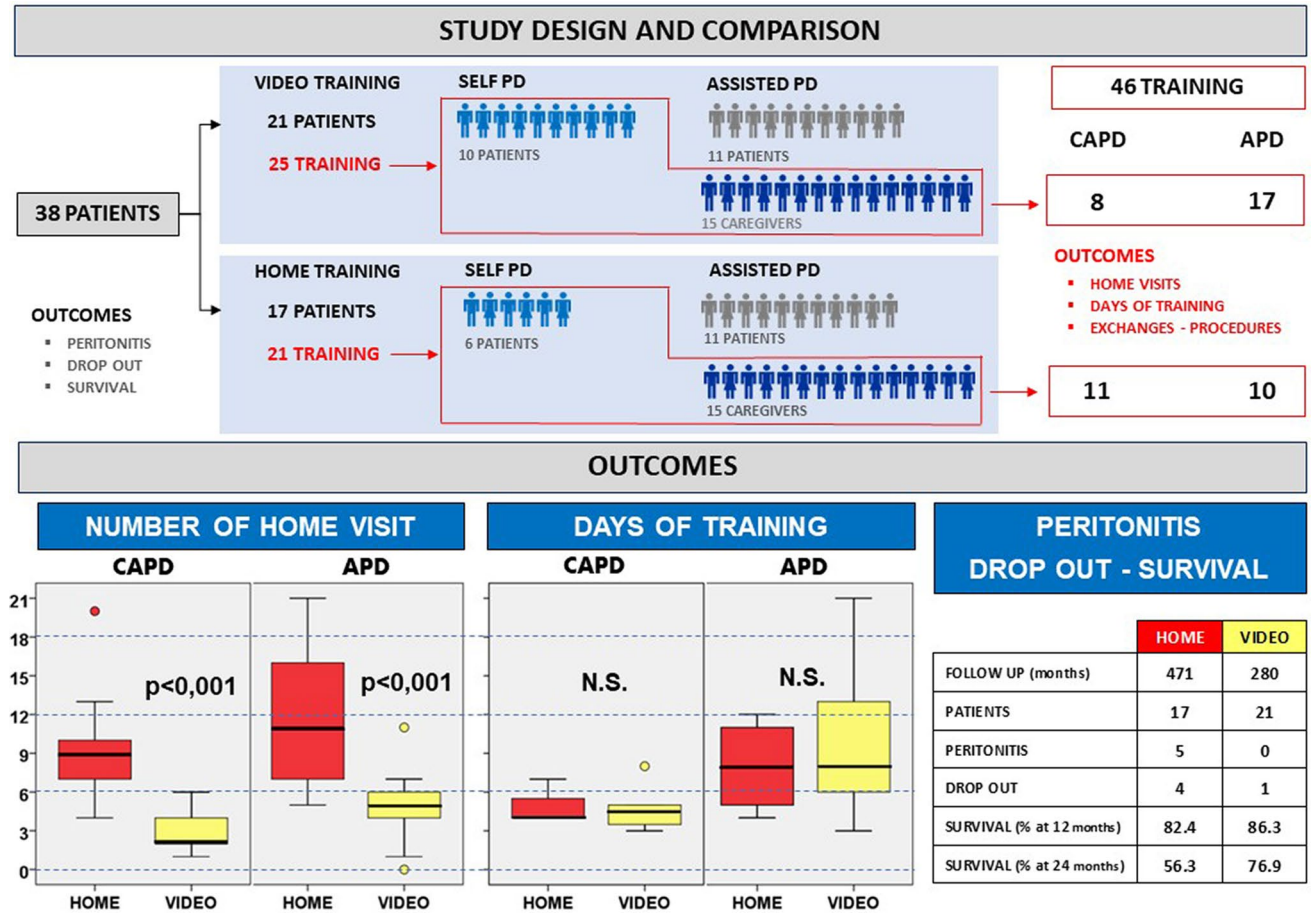
Graphical abstract



Keywords Peritoneal dialysis · Telemedicine · Videodialysis · Training · Assisted peritoneal dialysis

Introduction

Training in peritoneal dialysis (PD) is traditionally performed in hospital or at the patient's home [1].

In both cases a transfer is necessary, either of the patient to the hospital, or of the nurse to the home of the patient. This entails considerable utilization of resources, especially if the training is protracted (time for the elderly to learn) and the transfers are not easy (long distances, patients confined to bed), limiting the use of PD.

In the current COVID-19 pandemic moreover, the risk of contagion increases in the event of transfers.

A remote caregiving system used in our Center [2, 3] since 2002 has proved to be effective and safe in remotely guiding and assisting patients/caregivers who have barriers—in particular of a cognitive or psychological nature—to self-care PD (Videodialysis).

Since 01 August 2016, to overcome the limits of traditional training Videodialysis has also been used to carry out remote patient/caregiver training.

The aim of this paper is to analyze the results and effectiveness of remote training using Videodialysis (Video Training) by comparing it with those of the traditional training which our Center carried out at the patient's home (Home Training).

Materials and methods

This retrospective study comparing Home Training with Video Training was conducted on all 38 incident PD patients in our Center between 01/01/2014 and 05/31/2020, with at least 1 month of follow-up on PD after the beginning of training. The observation period ended on 06/30/2020.

The Video Training group included 21 incident PD patients between 08/01/2016 and 05/31/2020.

The Home Training group comprised 17 incident PD patients, 12 of whom were incident between 01/01/2014 and 07/31/2016 and 5 after 08/01/2016; the latter did not perform Video Training due to technical problems (4 Trainings for 3 patients) or refusal (2 Trainings for 2 patients).

All the patients or caregivers considered had no physical or cognitive barriers to self-care PD. The self-care barrier assessment criteria did not change throughout the two periods.

In all cases, only the first PD training performed to a patient/caregiver was considered. As illustrated in the Graphical Abstract, 16 of the recipients were self-care patients, while a total of 30 caregivers received training for 22 patients on assisted PD as 6 of these patients had more than one caregiver during the period of the study.

Exclusion criteria

Training performed in the following circumstances was excluded from the study:

1. PD in nursing homes in which the method is performed by in-house nurse (9 patients);
2. Use of indwelling Videodialysis [2, 3] due to psychological or cognitive barriers to PD (13 patients);
3. Peritoneal Ultra-filtration (PUF) [4] (2 patients);
4. Interruption of training (transplant: 2 patients—hospitalization: 1 patient—acute illness: 1 patient—refusal to continue: 1 patient—impossibility to continue: 1 patient);
5. Use of the two training methods for different caregivers (1 patient), to avoid the presence of the same patient in both groups;
6. Sharing of the dialysis procedures between more than one caregiver (1 patient).

Training method

The dialysis procedure is divided into a series of steps, the number of which varies depending on whether the procedure involves one exchange in Continuous Ambulatory Peritoneal Dialysis (CAPD), or the preparation, connection and disconnection from the cycler (Home Choice Claria–Baxter) in Automated Peritoneal Dialysis (APD). For the CAPD exchange, the procedures are differentiated according to the type of dialysis solution and whether the volume introduced into the abdomen is complete or partial, while in APD they depend on the type of bag and last fill, if any.

Patients have a manual illustrating the actions forming the procedure, and they are invited to read it while performing the dialysis.

The steps in the procedure are followed by all the nursing personnel involved in the Training, either at the patient's home in the case of Home Training or remotely in the case of Video Training.

Home Training

The nurse goes to the home of the patient, and illustrates and teaches the patient or caregiver how to perform the CAPD or APD technique in accordance with the principles recognized by international literature and guidelines [5, 6]. As well as the dialysis technique itself, the following subjects are also included in the training: the general principles and operation of PD, the prevention and recognition of complications in PD, personal and environmental hygiene standards, rules for a correct diet and the taking of medicines.

The training is carried out following a written step-by-step outline of the dialysis procedure, a copy of which is kept by the patient/caregiver.

For CAPD, several exchanges can be performed during each visit. For APD, the preparation and connection to the cycler are performed during the evening visit, while the disconnection takes place during a morning visit.

The training ends when the nurse considers the patient or caregiver to be capable of performing the dialysis procedure on their own.

Retraining takes place with a home visit 2–4 weeks following the end of the training.

Video Training

For this method, the training is carried out using the Videodialysis system described in a previous paper [2, 7].

For CAPD, the nurse visits the patient's home on two consecutive days: on the 1st day, the Videodialysis system is set up and the first exchange is performed, explaining it to the patient/caregiver; on the same day, the patient/caregiver is guided in the performance of a second exchange. On the 2nd day, the nurse is present again for assurance while the training is performed from the Center by another nurse using Videodialysis.

For APD, the nurse visits the patient's home on three consecutive days: on the 1st day, the Videodialysis system is set up and the dialysis procedure is performed, explaining it to the patient/caregiver; on the 2nd day, the patient/caregiver is guided in the performance of the dialysis procedure; on the 3rd day, the nurse is present again for assurance while the training is performed from the Center by another nurse using Videodialysis.

Starting from the 3rd and 4th day in CAPD and APD respectively, the training continues remotely using Videodialysis.

The Video Training ends when the patient/caregiver commits no errors for three consecutive procedures and is considered capable of self-care by the nurse.

Retraining in the dialysis procedure takes place in Videodialysis 2–4 weeks following the end of the training.

Comparisons and statistical analysis

The following were considered for the description and comparison of the two types of training:

1. the total duration of the training (number of days);
2. the number of home visits by the nurse, and the number of Videodialysis contacts;
3. the number of procedures (CAPD: exchanges—APD: preparation, connection and disconnection) required to complete the training;
4. the clinical outcome evaluated using incidence of peritonitis, drop-out to HD and patient/technique survival.

The "normality" was assessed by Shapiro–Wilk test. Since not all groups were found to have a normal distribution, the statistical comparison between the groups was made using non-parametric tests (Mann–Whitney *U* test) and the values are expressed by median and interquartile range (IQR).

Informed consent

All the patients/caregivers gave informed consent to the processing of their data. The study was approved by the Provincial Joint Ethics Committee (Number 92-2020 of 14/06/2020).

Results

Characteristics of the patients/caregivers

The characteristics of the 38 patients included in the study (Home Training: 17 patients—Video Training: 21 patients) are given in Table 1; none of them differed significantly between the two groups.

Table 1 Characteristics of the 38 patients at the start of dialysis treatment

	Home training	Video Training
Patients	17	21
Age	74.3 (53.3–80.9)	65.9 (56.8–78.4)
Males	10 (58.8%)	13 (61.9%)
Diabetes	6 (35.3%)	4 (19.0%)
Referral (early)	14 (82.4%)	15 (71.4%)
Assisted PD	11 (64.7%)	11 (52.4%)

Age = median (IQR). No differences between the two groups

The main characteristics of the 16 patients (Home Training: 6 patients—Video Training: 10 patients) and 30 caregivers (Home Training: 15 caregivers for 11 patients—Video Training: 15 caregivers for 11 patients) who underwent training are given in Table 2. Of the 46 trainings, 19 were in CAPD (Home Training: 11 training—Video Training: 8 training) and 27 in APD (Home Training: 10 training—Video Training: 17 training) (see Graphical Abstract—Study Design).

The global follow-up was 471 months in the Home Training group and 280 months in the Video Training group.

Characteristics of and comparison between the two types of training

CAPD

The details of the 2 training methods are given in Table 3.

Table 2 Characteristics of the 16 patients and 30 caregivers trained using the two methods

	Home training	Video training
Patients	6 (28.6%)	10 (40.0%)
Age	53.3 (45.5–70.0)	57.7 (45.4–62.8)
Males	5	7
CAPD	3	5
APD	3	5
Caregivers	15 (71.4%)	15 (60.0%)
Age	50.1 (45.4–54.2)	49.9 (44.1–56.9)
Males	2	5
Family members	11	8
Carers	4	7
CAPD	8	3
APD	7	12

Age = median (IQR). No differences between the two groups

Table 3 Characteristics of the two training methods in CAPD (Mann–Whitney *U* test)

CAPD	Home training median (IQR)	Video training median (IQR)	*p*
Number	11	8	
Days of training[a]	4 (4–6)	5 (4–5)	N.S
Calendar days[b]	5 (4–8)	5 (3–10)	N.S
Home visits	9 (7–10)	2 (2–4)	< 0.001
Exchanges at home	9 (8–11)	4 (3–5)	< 0.001
Exchanges by video	–	7 (5–8)	
Total exchanges	9 (8–11)	11 (9–12)	N.S

[a]Actual number of training days

[b]Days between start and end of training

The 11 Home Trainings and 8 Video Trainings carried out had a total duration (days of training; median and IQR) of 4.0 (IQR 4.0–5.5) vs 4.5 (IQR 3.8–5.5) days (p = NS) respectively over a period (calendar days) of 5.0 (IQR 4.0–6.5) vs 4.5 (IQR 3.0–8.5) days (p = NS) respectively.

The number of home visits in the Home Training and Video Training groups was 9.0 (IQR 7.0–10.0) vs 2.0 (IQR 2.0–3.5) ($p < 0.001$) respectively, and included 9.0 (IQR 8.0–10.8) vs 4.0 (IQR 3.0–5.0) ($p < 0.001$) exchanges.

In the Video Training group, the number of exchanges using Videodialysis was 7.0 (IQR 5.5–8.0), with a total of 11.0 (IQR 8.5–12.3) exchanges, which did not differ significantly from the Home Training group: 9.0 (IQR 8.0–10.8).

Each exchange in Video Training corresponded to one connection.

APD

The details of the two training methods applied to APD are given in Table 4.

The 10 Home Trainings and 17 Video Trainings carried out had a total duration of 8.0 (IQR 5.3–10.5) vs 8.0 (IQR 6.0–13.0) days (p = NS), respectively, over a period (calendar days) of 16.5 (IQR 13.3–24.5) vs 22.0 (IQR 16.0–28.0) days (p = NS), respectively.

The number of home visits in the Home Training and Video Training groups was 11.0 (IQR 7.8–15.5) vs 5.0 (IQR 4.0–6.0) ($p < 0.001$) respectively, and included 16.5 (IQR 13.3–24.5) vs 8.0 (IQR 7.0–10.0) ($p < 0.001$) procedures (preparation–connection–disconnection).

The ratio in the two groups between procedures and number of home visits was 1.6 (IQR 1.4–1.6) vs 1.5 (IQR 1.5–1.6) (p = NS).

The number of procedures performed in Video Training using Videodialysis was 10.0 (IQR 9.0–19.0), with a total of 22.0 (IQR 16.0–28.0) procedures, which did not differ significantly from the Home Training group: 16.5 (IQR 13.3–24.5).

The procedures using Videodialysis were carried out with 9.0 (IQR 6.0–12.0) video connection, corresponding to 1.1 (IQR 1.0–1.3) procedures for each video connection.

The number of preparation, connection and disconnection procedures carried out in the two groups, at home and in Videodialysis, is given in Table 5.

Table 4 Characteristics of the two training methods in APD (Mann–Whitney *U* test)

APD	Home training median (IQR)	Video training median (IQR)	*p*
Number	10	17	
Days of training[a]	8 (5–11)	8 (6–13)	N.S
Calendar days[b]	10 (8–12)	12 (6–17)	N.S
Home visits	11 (8–16)	5 (4–6)	< 0.001
Procedures at home	17 (13–25)	8 (7–10)	< 0.001
Procedures by video	–	10 (9–19)	
Total procedures	17 (13–25)	22 (16–28)	N.S

[a]Actual number of training days

[b]Days between start and end of training

Outcome

Peritonitis

In the Home Training group, 5 episodes of peritonitis occurred, 2 of which were caused by *Staphylococcus epidermidis*, 1 by Staphylococcus aureus, 1 by *Escherichia coli* during UTI, and 1 by *Enterococcus faecalis* which led to drop out to HD, while no cases of peritonitis were observed in the Video Training group.

Drop-out

In the Home Training group, 4 cases of transfer to HD were recorded (1 due to peritonitis at 7.0 months—1 to adequacy at 8.3 months—1 to UFF at 15.1 months—1 by choice at 32.2 months), while there was only 1 case of transfer to HD at 6.9 months in the Video Training group, due to OSAS.

Patient and technique survival rates at 12 and 24 months were 82.4% and 56.3% in the Home Training group, while the rates of 86.3% and 76.9% in the Video Training group were not statistically different (Fig. 1).

Table 5 Number of preparation, connection and disconnection procedures performed in the two training methods

APD	Home training median (IQR)	Video training median (IQR)
Preparation		
At home	7 (5–9)	3 (2–3)
In Videodialysis	–	4 (3–7)
Total	7 (5–9)	8 (5–10)
Connection		
At home	7 (5–9)	3 (2–3)
In Videodialysis	–	4 (3–7)
Total	7 (5–9)	8 (6–11)
Disconnection		
At home	4 (3–7)	2 (2–3)
In Videodialysis	–	3 (2–5)
Total	4 (3–7)	6 (4–8)

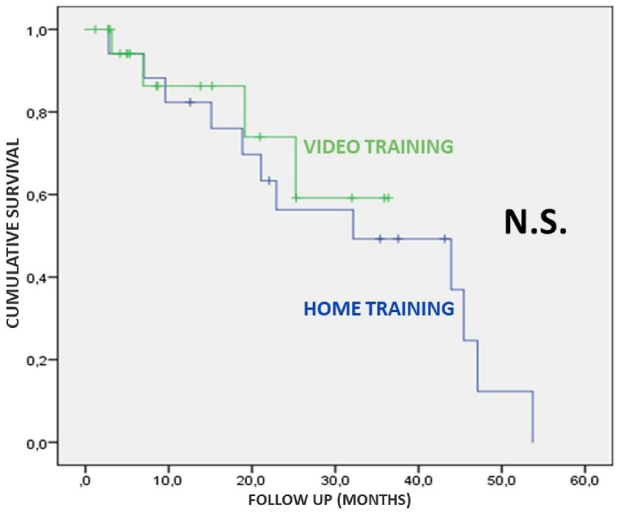


Fig. 1 Patient and technique survival

Discussion

This paper reports the first experience of remote CAPD and APD training with the aim of evaluating its validity in terms of efficiency and effectiveness compared to traditional training.

In the case of both techniques, the training was performed by the same personnel all from the same Center with at least one year of experience in PD, as the duration and efficacy of the training depend on both the healthcare worker's teaching ability and the patient's learning capacity and characteristics [6].

In this respect, the patients in the two groups had similar characteristics in terms of age, gender, diabetes and need for caregiver. Furthermore, no physical or cognitive barriers to self-care resulted from the nursing assessment carried out prior to the training in any of the patients or caregivers trained in either group. Since the barrier assessment criteria remained the same, selection bias seems highly unlikely, as is further suggested by the higher number of caregivers trained in the Home Training group than in the Video Training group.

In CAPD, in our experience Video Training significantly reduces the number of home visits by the nurse (− 69.6% vs Home Training). However, the total duration and the number of exchanges are superimposable, confirming the validity of remote training.

In APD too, Video Training significantly reduces the number of home visits by the nurse (− 57.2%), although the total duration and number of sessions required to complete the training were greater, with a higher Coefficient of Variability.

This result may have been due to the greater complexity of the procedure in APD than in CAPD, and by the stricter parameters applied to consider the training in this method completed. As a matter of fact, the training in APD using the Video Training method was considered completed on the basis of the nursing assessment made after a minimum number of three consecutive procedures with no errors.

The reduction in the number of home visits by the nurse saves travelling time and reduces costs and inconvenience. In many Centers, training is carried out in the hospital [1]; by reducing the number of patient/caregiver home-to-center transfers, Video Training lowers costs and improves the quality of life of the patient and/or caregiver.

Finally, during the current COVID-19 pandemic, fewer transfers also means fewer opportunities for contagion.

A further advantage of Video Training is represented by its greater flexibility and the customizability of its duration. This is confirmed by the higher percentage variation in Video Training compared to Home Training between days of training and calendar days in both CAPD (26.1% vs 12.2%) and in APD (34.4% vs 26.2%), and the higher variability recorded for the total number of procedures required for the learning of APD. This suggests that Video Training is more adaptable to the availability and learning capacity of the patient/caregiver.

On the other hand, limitations to the use of Video Training may be represented by insufficient connectivity (4 Trainings for 3 patients—12.9% of those eligible for Video Training) or the refusal of the patient/caregiver (2 trainings for 2 patients—6.5% of those eligible for Video Training).

The outcome data relating to the incidence of peritonitis and drop-out are further confirmation of the efficacy of this method of training.

The preliminary data from this study incentivize the extension of the study to a larger, multi-center cohort.

Conclusions

In our experience, compared to traditional training this remote method makes it possible to significantly reduce the number of personnel and/or patient/caregiver transfers, to adapt the training to the needs and learning capacity of the patient/caregiver, and to guarantee superimposable outcomes. Furthermore, in a situation such as the current pandemic, this Telemedicine system reduces the risks of contagion for both patients and healthcare workers.

Declarations

Conflicts of interest The authors have no relevant financial or non-financial interests to disclose.

Ethics approval Comitato Etico Interaziendale (AO S.Croce e Carle-Cuneo; ASLCN1; ASLCN2; Asti)—N° 92/2020—Observational retrospective no profit study: approved.

References

1. Bernardini J, Price V, Figueiredo A, Riemann A, Leung D. International survey of peritoneal dialysis training programs. Perit Dial Int. 2006;26:658–63.
2. Viglino G, Neri L, Barbieri S, Tortone C. Videodialysis: a pilot experience of telecare for assisted peritoneal dialysis. J Nephrol. 2020;33:177–82.
3. Viglino G, Neri L, Barbieri S, Tortone C (2019) La dialisi peritoneale nell'anziano. Giornale Italiano di Nefrologia 2019(Suppl 79)
4. Viglino G, Neri L, Feola M. Peritoneal ultrafiltration in congestive heart failure-findings reported from its application in clinical practice: a systematic review. J Nephrol. 2015;28:29–38.
5. Hall G, Bogan A, Dreis S, Duffy A, et al. New directions in peritoneal dialysis patient training. Nephrol Nurs J. 2004;31:149–54 (**159–63**).
6. Figueiredo AE, Bernardini J, Bowes E, Hiramatsu M, et al. A syllabus for teaching peritoneal dialysis to patients and caregivers. Perit Dial Int. 2016;36:592–605.
7. Tortone C, Barrile P, Baudino S, Neri L, Barbieri S, Viglino G (2022) Videotraining and expert system: a new peritoneal dialysis training model. In: Methodologies and intelligent systems for technology enhanced learning, 11th international conference. MIS4TEL 2021. Lecture notes in networks and systems, vol 326. Springer, Cham. https://doi.org/10.1007/978-3-030-86618-1_25