

Assessment for Learning in face-to-face and in emergency virtual teaching at university: satisfaction and frustration of students' Basic Psychological Needs

Evaluación para el aprendizaje en enseñanza presencial y virtual de emergencia en la universidad: satisfacción y frustración de las Necesidades Psicológicas Básicas del estudiantado

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Short title:

Assessment for Learning and Basic Psychological Needs

How to cite this article:

Lorente-Catalán, E., Leão-Pereira, A., Castel, D., & Joven, A. (2023). Assessment for learning in face-to-face and in emergency virtual teaching at university: satisfaction and frustration of students' Basic Psychological Needs. *Cultura, Ciencia y Deporte*, 18(55), 91-104. <https://doi.org/10.12800/ccd.v18i55.1958>

Received: 28 July 2022 / Accepted: 10 October 2022

Abstract

The satisfaction and frustration of basic psychological needs (BPN) in Assessment for Learning (AfL)-based interventions in the context of Physical Education Teacher Education is a research area that has not received much attention. This study measures students' BPN in two consecutive cohorts (face-to-face and emergency virtual teaching) during a module at university that uses AfL in an autonomy supportive learning environment. The Satisfaction and Frustration of the Basic Psychological Needs Scale for Training was administered to fourth year students. Qualitative open-ended questions were incorporated into the questionnaire to deepen on students' opinions on the experience. The results showed high levels of BPN satisfaction plus low levels of frustration in both face-to-face and virtual teaching. Likewise, students confirmed the importance of autonomy, structure and feedback in virtual classes, which supports the idea that autonomy and structure are complementary and not contradictory. It also shows how technologies in virtual teaching generated commitment and learning, favoring continual feedback on tutored work. Although this study contributes to scaling up the empirical evidence of the effects of AfL on motivation, a lot of terrain remains to be explored on its implementation in university contexts that support BPN.

Keywords: formative assessment, self-determination theory, motivation, Physical Education Teacher Education.

Resumen

La satisfacción y frustración de las necesidades psicológicas básicas (NPB) en intervenciones que utilizan la Evaluación para el Aprendizaje (EpA) en el contexto de la Formación Inicial del Profesorado de Educación Física, es un área de investigación que no ha recibido mucha atención. Este estudio analiza las NPB del estudiantado en dos cohortes consecutivas (presencial y enseñanza virtual de emergencia) en una asignatura que utiliza la EpA en un entorno de apoyo a la autonomía. La Escala de Satisfacción y Frustración de las Necesidades Psicológicas Básicas para la Formación se administró al alumnado de cuarto curso del Grado de Ciencias de la Actividad Física y Deportes. Se incorporaron al cuestionario preguntas cualitativas abiertas para conocer la opinión del estudiantado sobre la experiencia. Los resultados mostraron un alto nivel de satisfacción con baja frustración de las necesidades tanto en la docencia presencial como virtual. Asimismo, se confirmó la importancia que el estudiantado da a la autonomía, la estructura y la retroalimentación en las clases virtuales, lo que sustenta la idea de que la autonomía y la estructura se complementan y no son contradictorias. También muestra cómo las tecnologías en la enseñanza virtual generaron compromiso y aprendizaje facilitando la retroalimentación continua del trabajo tutorado. Aunque este estudio contribuye a ampliar la evidencia empírica de los efectos de la EpA en la motivación, queda mucho terreno por explorar sobre su implementación en contextos universitarios que apoyen las NPB.

Palabras clave: evaluación formativa, teoría de la auto-determinación, motivación, Formación Inicial Profesorado de Educación Física.



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Introduction

Recent studies on Higher Education have found that assessment is still among the least satisfactory aspect of students' experience (Carless, 2017; Winstone & Carless, 2020). This situation creates a need to explore assessment proposals that focus on helping students to learn and generate motivation to persevere on learning. Based on this premise, it could be considered that Assessment for Learning (AfL) in interventions that supports the Basic Psychological Needs (BPN) (Deci & Ryan, 2000) might improve students' motivation.

The following sections address three topics: the concept of AfL used in HE, and specifically what it means in the context of Physical Education (PE) and Physical Education Teacher Education (PETE); the importance of creating educational environments that meet students' basic psychological needs, as research on the subject shows that this satisfaction generates high motivation, which in turn is an important predictor of academic achievement and psychological well-being; and finally, how motivation and well-being has special importance in a situation of uncertainty such as that experienced during emergency e-learning, where psychological well-being may have been undermined.

Assessment for Learning in Physical Education and Physical Education Teacher Education

AfL is understood to be a system in which teachers, students or their classmates obtain, interpret and use the evidence on the students' achievements to take decisions on the next steps to be taken to improve learning or give them better foundations than those that would have been taken in the absence of the evidence obtained (Black & William, 2009). In spite of a certain consensus on this concept, there appears to be no definitive agreement on the key AfL strategies (Carless, 2017). This author proposed to synthesize these strategies as: design of productive assessment tasks, effective feedback processes, development of students' understanding of quality, and activities that enable them to make judgements. Even though there has been a proliferation of such strategies, their implementation in academic programs is still being questioned (Carless, 2017; Kvale, 2007).

Among these strategies, effective feedback deserves special attention as it is regarded as an important aspect of AfL (Carless, 2017; William, 2018; Winstone & Carless, 2020). It is defined as learners making sense of the information on their performance to improve the quality of their work or learning strategies (Boud & Molloy, 2015). Hattie and Timperley (2007) consider that feed-up, feedback and feedforward principles should be followed to integrate assessment into the learning process. The first one shows where the student is going, the second where he is and the third tells how to reach the target. Ideally, both students and teachers should actively participate in strategies that enable the former to become independent, self-controlled (Boud & Molloy, 2015), and "literate" (Schellekens et al.,

2021). Also, the teaching context where the feedback is done should be considered (William, 2011, 2018).

In the last 20 years, many studies on this topic in the field of school PE and PETE have been published that show the interest for AfL in schools and universities and bring evidences of its benefits (e.g. Borghouts et al., 2016; Chng & Lund, 2018; Hay, 2006; Leirhaug & MacPhail, 2015; López-Pastor et al., 2013; Lorente-Catalán & Kirk, 2016; Macken et al., 2020; Moura et al., 2021; Slingerland et al., 2016; Starck et al., 2018; Tolgfors & Öhman, 2016).

Assessment in PE in schools has been strongly influenced by the work of Hay & Penney (2009), who define the conditions of assessment efficacy as: a) focus on assessment for learning, b) authentic assessment connecting learning with problems in the real context in which it will be used, c) ensure the validity of the instruments used, and d) use a socially fair approach. As some authors (Lorente-Catalán & Kirk, 2016; Moura et al., 2021; Starck et al., 2018) and the Association Internationale des Écoles Supérieures d'Éducation Physique (AIESEP) (2020) have stated, if future teachers have to learn to include these conditions, they should be present in PETE programs not only in the form of content knowledge, but also as a part of university teachers' methods so as to be exemplary in their own evaluation practices.

In PETE, AfL is based on 5 principles: a) making the intentions and the criteria of success clear, b) planning effective classroom discussions and other learning tasks to obtain evidence of students' understanding, c) providing feedback to help students advance to the next learning step, d) encouraging them to act as teaching resources to each other, and e) making them the protagonists of their own learning (Leirhaug & MacPhail, 2015; Tolgfors & Öhman, 2016).

This discourse has been adopted all over the world, as shown by the Position Statement on Physical Education Assessment published by the AIESEP in 2020. However, it is also a globalizing discourse that has to be understood and explained from a globalization viewpoint (Tolgfors & Barker, 2021), i.e. a combination of global and local educational traditions. In this case, the study was carried out in Spain, where there have been attempts to transform assessment practices, not only in educational policies but also in professional practice (López-Pastor et al., 2016; López-Pastor & Pérez-Pueyo, 2017).

As feedback is a key element in AfL, and bearing in mind that students' motivation, self-perception and experience of assessment has an important influence on how they receive it (Deci & Ryan, 1994), it seems relevant to study their motivation when they experience AfL in their initial training.

Psychological needs satisfaction and motivation in initial training

There are many theories on human motivation. One of the most consolidated ones is the Self-Determination Theory (SDT) (Ryan & Deci, 2000), which assumes that people are

inherently prone to grow and integrate psychologically. From this idea, one of the six SDT mini-theories, the Basic Psychological Need Theory (BPNT) (Ryan & Deci, 2000; Vansteenkiste et al., 2020), emerged. The term "psychological need" is defined as a psychological nutrient essential for individuals' adjustment, integrity and growth (Ryan, 1995). Thus, Ryan and Deci (2000) identified 3 BPN: autonomy, competence and relatedness. Nowadays, the creators of the theory define them as follows (Ryan & Deci, 2020):

Autonomy concerns a sense of initiative and ownership in one's actions. It is supported by experiences of interest and value and undermined by experiences of being externally controlled, whether by rewards or punishments. Competence concerns the feeling of mastery, a sense that one can succeed and grow. The need for competence is best satisfied within well-structured environments that afford optimal challenges, positive feedback, and opportunities for growth. Finally, relatedness concerns a sense of belonging and connection. It is facilitated by conveyance of respect and caring (p. 3).

Studies have shown that satisfying these needs promotes high quality motivation, resilience and welfare and thwarting them causes vulnerability, lack of motivation and a defensive attitude (Ryan & Deci, 2017). However, learning, mastery and connection with others are not automatic, requiring support for their consolidation (Ryan & Deci, 2020).

A meta-analysis of effective training programs on the motivation suggested some conditions that should be included in this type of programs to satisfy BPN, e.g. a non-controlling language, offering choices, follow-up activities, written and virtual supporting material, knowing the results, and the participants' previous values of strategies supporting autonomy (Su & Reeve, 2010).

These conditions applied to the training programs of future PE teachers could serve as a motivation to adopt the content knowledge, as an example to teach their future pupils and as an incentive to change their beliefs. Furthermore, experiencing satisfaction is not only related to changing beliefs but also to the intention of applying the changes, by producing more receptivity and less resistance to change (Aelterman et al., 2013; Aelterman et al., 2015; Näsström et al., 2021).

The latest advances in the conditions for supporting autonomy consider the question of how to combine a teaching style that supports autonomy with other aspects that might seem contradictory, such as structure, establishing expectations, follow-up and feedback, and producing more adaptive results (Vansteenkiste et al., 2020), aspects closely related to AfL. In this line, Jang, Reeve & Deci (2010) showed that autonomy and structure were positively interrelated and thus were complementary and not contradictory.

On the other hand, the satisfaction of BPN has been related to intrinsic motivation (Vansteenkiste et al., 2020).

Intrinsic motivation "refers to doing something because it is inherently interesting or enjoyable" (Ryan & Deci, 2000, p. 55). It makes learning faster and more pleasant (Ryan & Deci, 2020) and it is an important predictor of performance in educational settings, especially for its impact on students' commitment (Ryan & Deci, 2017). It is, therefore, logical to stimulate and maintain intrinsic learning motivation in university teaching as it affects not only academic results but also students' welfare and psychological growth (Holzer et al., 2021). This is an aspect that may become more relevant when the context changes unexpectedly, for example, because of an emergency e-learning situation such as the one experienced during the pandemic.

Motivation in emergency virtual teaching and learning

Covid-19 pandemic obliged schools and universities to deliver classes online, which affected students' motivation (Chiu, 2021; Huang & Wang, 2022). In times of unplanned remote studying, Holzer et al. (2021) highlight the relevance that all three BPN as well as self-regulated learning can be specifically promoted for university students' well-being. In these special circumstances, Malinauskas and Pozeriene (2020) found higher intrinsic motivation in those who followed online classes than in those in face-to-face classes.

In relation to learning, a study of students' implication and success in online classes showed the importance of providing frequent feedback for these to achieve a positive perception and improve the results of their activities (Chen et al., 2021).

The pandemic also gave rise to many technological tools including interactive platforms to assist in follow-up and assessment processes which could be used to promote motivation, commitment and learning (Ryan & Rigby, 2019). However, it is fundamental to use them in the service of assessment and not the other way round, allowing them to dictate what and how to teach and evaluate (AIESEP, 2020).

The present study

The literature review reveals a significant interest in research on AfL. Some of these studies have shown that AfL has a considerable effect on the perception of students' autonomy and self-efficiency (Granberg et al., 2021). Nevertheless, there is still little empirical evidence to corroborate the hypothesis of the strong effect of AfL on intrinsic motivation (Näsström et al., 2021). Also, no empirical evidence of AfL-based interventions on satisfying/frustrating the BPN have been found in the context of PETE on comparing two different situations such as face-to-face and emergency virtual teaching. Thus, this intervention study aims to fill in this gap by answering three questions:

RQ1: Does an AfL-based intervention contribute to students' NPB satisfaction?

RQ2: What are the differences in the satisfaction and/or frustration of NPB when applying AfL in face-to-face and emergency virtual teaching?

RQ3: What are the students' opinions about this intervention in emergency virtual learning?

Method

A mixed methods design was applied which enabled us to examine both quantitative and qualitative aspects of the students' experiences to gain a better understanding of students' opinions on the experience (Tashakkori & Teddlie, 1998).

Context and Participants

This study involved a compulsory subject in the fourth year of the Sciences of Physical Activity and Sports degree program at a Spanish university in which weekly classes were structured into two theoretical and one seminar class. An initial group of 135 students participated, wherein 32 were women and 103 men. Four of these were eliminated by the univariate and multivariate tests for either exceeding the values in the different variables over or under three times the standard deviation (univariate normality reference values) or for excessive values of the Mahalanobis Distance (multivariate normality indicator), leaving 131 individuals in the final sample (average age=22.44; SD=2.41). Out of this total, 37 students belonged to the 2019-20 year and participated in face-to-face classes, whereas 94 belonged to the 2020-21 year and were involved in emergency virtual classes.

Their teacher had 30 years of teaching experience, mastery of PE and assessment and was a member of the Spanish network called the National Network of Formative and Shared Assessment in Education.

Intervention design

The intervention took place over 7 weeks and it focused on teaching how to design efficient good-quality assessment in different contexts of teaching-learning. The students, in groups, had to organize an activity with a real population and design an assessment of the pupils' learning process, based on Hay and Penney's PE recommendations (2009). This tutored work was carried out in seminar sessions. The pedagogical approach used in the subject also aimed to follow the same principles, while creating a learning-support context (Schellekens et al., 2021) that supported the basic BPN, as recommended for highly effective programs from the viewpoint of motivation (Su & Reeve, 2010).

The following sub-section describes how the AfL principles were applied and how the BPN were supported during the intervention.

Assessment for learning

To support the students' learning feed-up was provided at the start sharing the aims of the tutored work. A rubric was proposed to facilitate the work and its format and criteria were discussed with the students. To stimulate self-regulation, the aims of the lesson were considered

at the start of each session and at the end the students were invited to reflect on their achievement and on what would help them to plan the next steps, while satisfying the need for autonomy and helping to give the learning process a better structure. In each session a new concept was introduced to be applied to their particular case while the teacher supervised and answered any doubts. Feedback and feedforward were given to all groups during the seminar sessions and in the following week, in addition, students could ask for help at any time. Before the final session the students had a peer assessment with a formative function which intended to satisfy the need for competence and also the relatedness, since the group self-assessment and the peer assessment required a respectful and empathetic relationship.

Authentic assessment

The requested work accomplished an authentic task which intended to solve the problem of how to carry out an effective assessment in a specific context. The students had to design instruments to collect relevant and reliable information for the aims of the intervention, adjust it to the context and also make it viable and sustainable in professional circumstances. The task intended to give support to competence and autonomy.

Ensuring validity

A rubric was discussed and agreed with the students to assess and grade the assignment from three perspectives: that of the teacher, the peers' formative feedback before submitting the final assignment to contribute ideas and suggest improvements, and the group's self-assessment in which the grade was distributed according to individual contributions. This initiative aimed to support the three BPN.

Socially just approach

The proposed assessment was negotiated with the students so that they actively participated in the final grade. Personalized attention was sought during the practice, the data was considered to be confidential and personal opinions and actions were respected. The transparency of the criteria and the possibility of carrying out a peer assessment plus a self-evaluation aimed to support competence, autonomy and relationship.

Adaptation of face-to-face approach to emergency virtual teaching

Due to the Covid-19 pandemic, classes were forced to change completely to online classes in the second year of the study. The original approach was essentially maintained with some changes, e.g. some groups could carry out their intervention with their pupils but other groups could not and so they were provided with a recording of a session from a previous year. The work was carried out on the

Padlet Platform, an interactive, transparent and live platform that can create collaborative murals with the possibility of constructing spaces for presenting multimedia resources in the form of videos, audios, photos or documents (see www.padlet.com).

The materials required for the assignment were given on the platform. Each group was assigned a column to continue a dialogue with the teacher. A task related to the final work was assigned in each session. The teacher could participate in the different virtual rooms to answer questions. The groups uploaded their work to the platform and were given feedback and feedforward on the task by the teacher in the following week. Feedback was given to all groups in the first practice session but in the following ones they were asked to give their opinion of the teacher feedback. Any group that did not provide this information received no formative feedback in future tasks unless they expressly asked for it. All materials, comments, feedback and tasks were always visible to all the groups so that when a group had a doubt they could solve it by consulting the feedback given to another group.

Before handing over the assignment, a peer assessment was carried out on the platform. The groups gave formative feedback to each other and left a qualitative comment on the platform to generate inter-group dialogue. The information received could be used to improve the work before the final handover. The initial agreement with the group was respected for the final grade, bearing in mind the teacher's grade (80% of the mark) and the group self-assessment (20%). In the self-assessment they had to assess the task itself and also their self-regulation process during the development of the work. Each group decided on the distribution of the grade according to the work carried out by each member. The same instrument (rubric) proposed and discussed by all at the start of the subject was used by all the evaluating agents.

Data collection

In each academic year of the teaching intervention, with the previous consent of the students and the assurance of anonymity, the Satisfaction and Frustration of the Basic Psychological Needs Scale (BPNSFS) (Chen et al., 2015) adapted for Training by Aelterman et al. (2015) was administered. The scale consisted of 24 items (four for each factor) divided into: satisfaction of autonomy, frustration of autonomy, satisfaction of competence, frustration of competence, satisfaction of relatedness and frustration of relatedness. This was introduced by the following premise: "You are asked to give your opinion on the teaching received in the subject. Consider the knowledge acquired, class strategies and the group relationship and indicate the degree to which each item is true for you at this time". The six factors included four items which were assessed on a 5-point Likert scale, e.g. an item on the satisfaction of autonomy, "I felt I was free to choose what I did and thought"; for frustration of autonomy, "I felt compelled to do things

that I would not have chosen to do"; to satisfy relatedness, "I felt close to/connected with the other participants", and frustrate relatedness, "I had the impression that the other participants had less respect for my opinion"; to satisfy competence, "I was confident I could apply the proposed strategies", and to frustrate competence, "I had doubts as to whether I could apply the proposed strategies".

The reliability of the questionnaire was assessed by McDonald's Omega and provided the values of .712 for satisfaction of autonomy, .745 for frustration of autonomy, .859 for satisfaction of relatedness, .650 for frustration of relatedness, .813 for satisfaction of competence and .663 for frustration of competence.

The questionnaire also incorporated a series of qualitative open questions to obtain information about the experience as well as a comparison of the online versus face-to-face teaching in the second year.

Data analysis

BPNSF scale for training

The first step was a descriptive analysis of the complete sample divided into groups using the mean (*M*) and standard deviation (*SD*). The measure's reliability was calculated by McDonald's Omega and the MANOVA factor (Group) to inter-group differences. A hierarchical analysis cluster classified students in different groups in a 2-step procedure (i.e. hierarchical and non-hierarchical analysis cluster methods; Garson, 2014) to identify different BPN satisfaction and frustration profiles. Previously, standardized values were calculated of the cluster components and participants with more or less than 3 times the mean *SD* or high Mahalanobis values were eliminated to reduce the impact of the untypical univariate and multivariate values, respectively (Steinley & Brusco, 2011).

The first step consisted of a hierarchical cluster analysis by the Ward Method based on squared Euclidean distances. Two and three different profiles were tested. To identify the optimal number of solutions, the theoretical interpretation and the percentage of variance explained by each solution were considered (Aguinis et al., 2013).

In the second step, a non-hierarchical iterative grouping procedure of k-means using the centers of the initial clusters extracted by the Ward Method as non-random starting points. The solution of retained clusters was examined by Cohen's Kappa (values over .50 were acceptable) by the double-division cross-validation procedure.

Finally, an analysis of multivariate variance (i.e. Manova) was performed to examine possible differences in the identified profiles. The size of the effect was reported by the partial Eta Squared statistic (η^2p), considering (>.01) as small, (>.06) mean and (>.14) large, respectively (Cohen, 1988). The Chi-square method was used to analyze possible associations between categorical variables. All the analyses were carried out on the SPSS v23 statistical package.

Open-ended "ad hoc" questions

The technique used was the documentary analysis. The data was registered in three questionnaire answer templates which served as documentary sources inserted in PDF format on Atlas.ti 9.0 software. A fluctuating reading was then performed to identify words or phrases in the students' answers into the questionnaire's open-ended questions. This was a codifying process in which each fragment of the answers was assigned a code or a meaning. Topics were formed for a group of codes that emerged in the patterns or recurrences in the answers, performing an inductive analysis by subjects that responded to the study's third aim.

Out of the six methods identified for the first codification cycle proposed by Saldaña (2013), the "Elementary method" with characteristics of "Descriptive codification" was used. The basic topic of the phrases was simplified in a short phrase that could also be self-explanatory.

Positive aspects were extracted from the questions:

"What aspects would you highlight as positive in the approach used in the subject?" and "What aspects surprised you or provided something positive in the online classes?". Starting from them, eight codes were identified of the abovementioned questions which will be shown in Results (Table 3).

Twenty codes were identified out of the following questions:

"What aspects do you think could/should be improved?" and "What aspects did you think were lacking due to

the present circumstances that led to obligatory online classes?". These questions are related to what could be improved and what students "missed in online teaching" and they will be shown in Results (Table 4).

To pass on to the second codification phase, the themes were organized by the groups of the analysis units found, where the explanatory codes of the first cycle were grouped into fewer themes (Saldaña, 2013) after being subjected to a semantic analysis. Out of the 8 codes generated previously in positive aspects, 3 thematic categories were created as follows: pedagogic strategies, agents' profiles and situated learning. Out of the 20 previously generated in negative aspects, 4 thematic categories were created: no face-to-face classes, organization of the subject, non-situated learning and nothing to be improved.

Findings

Satisfaction and frustration of Basic Psychological Needs in face-to-face and in emergency virtual classes

Descriptive analysis of group differences (year)

Table 1 gives the descriptive statistics and an analysis of group differences (years 2019-20 and 2020-21). The MANOVA of each year for the set of variables for the different years shows no significant effect of the group (year): Wilks' Lambda = .974; $F_{6, 124} = .547$; $p = .771$; $\eta^2 p = .026$.

Table 1. Descriptive statistics and analysis of group differences (year)

| | 2019-20 | | 2020-21 | | F | p | $\eta^2 p$ |
|--------------------------|----------------|------|-----------|------|------|------|------------|
| | (Face-to-face) | | (Virtual) | | | | |
| | (N = 37) | | (N = 94) | | | | |
| | M | SD | M | SD | | | |
| Satisfaction BPN | 4.007 | .445 | 3.994 | .469 | .021 | .885 | .000 |
| Frustration BPN | 1.890 | .505 | 1.850 | .480 | .174 | .677 | .001 |
| Satisfaction Autonomy | 3.764 | .517 | 3.838 | .560 | .486 | .487 | .004 |
| Satisfaction Competence | 4.014 | .530 | 3.915 | .622 | .723 | .397 | .006 |
| Satisfaction Relatedness | 4.243 | .716 | 4.229 | .671 | .012 | .913 | .000 |
| Frustration Autonomy | 1.966 | .886 | 1.926 | .715 | .075 | .785 | .001 |
| Frustration Competence | 2.182 | .539 | 2.120 | .668 | .260 | .611 | .002 |
| Frustration Relatedness | 1.520 | .535 | 1.505 | .459 | .026 | .873 | .000 |

M: mean; SD: standard deviation

Cluster analysis

Before identifying the clusters, 4 atypical univariate and multivariate values were eliminated from a total sample of 131 students. Finally, two significantly different profiles were identified that explained a 43% variance in BPN satisfaction and 62% in their frustration. In the solution of two clusters, the crossed double-division procedure

provided an average Kappa value of .81, indicating excellent stability. The Chi-squared test showed no significant association between clusters and gender ($\chi^2 [1, n = 131] = .001, p = .98$), and so gender was not used as a covariable in the subsequent analyses.

The graphic results for the solution of two groups based on Z scores (i.e. standardized scores; Y axis) for the BPN

satisfaction and frustration variables are shown in Figure 1. The graphic results for the solution of both groups based on the standardized punctuations are shown in Fig. 1a and the absolute punctuations in 1b. From left to right, the first group has the most adaptable profile (Cluster 1, $n = 68$, 52%) and the second group has the least one (Cluster 2; $n = 63$; 48%).

Cluster 1 has the highest satisfaction values and relatively low frustration values, while Cluster 2 has a different pattern, with higher frustration and lower satisfaction values in relation to cluster 1.

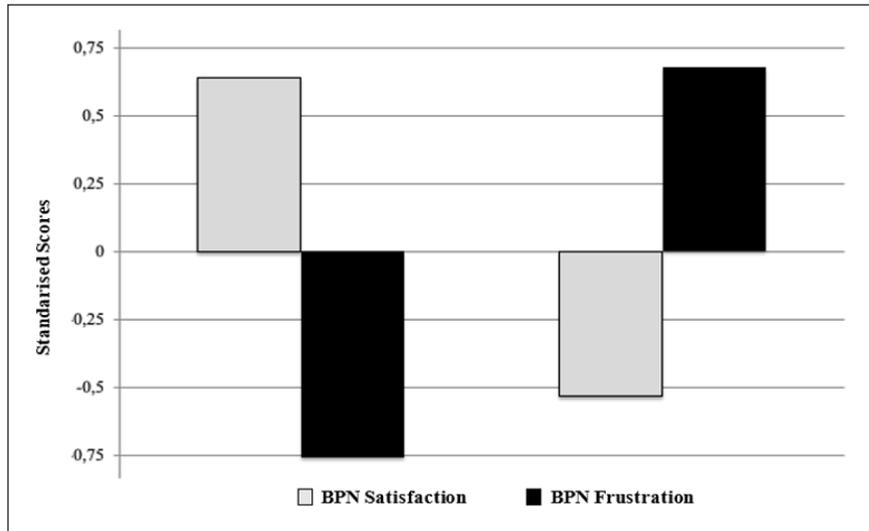


Figure 1a. Graphic representation of groups (clusters) with standardized scores

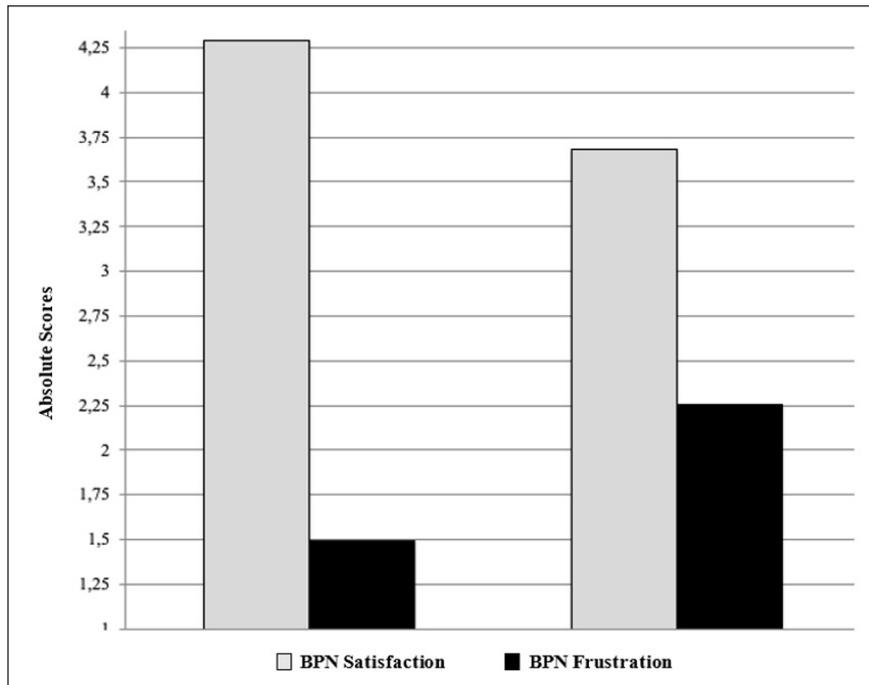


Figure 1b. Graphic representation of groups (clusters) with absolute scores

The analysis of differences as a function of cluster through the one-factor MANOVA indicates a main effect of cluster in all the variables analyzed (Wilks' Lambda = .304; $F(6, 124) = 47.227$; $p < .001$; $\eta^2 p = .696$). Table 2 shows that there are significant differences in all the variables of the study as a function of cluster.

Finally, the distribution of students in each cluster by year indicates that in Cluster 1 there are 49 students belonging to year 2020-21 (Virtual) out of a total of 98 (50%), and 19 from 2019-20 (Face-to-face) out of a total of 37 (51.4%). In Cluster 2 there are 45 students from 2020-21 out of a total of 98 (45.9%) and 18 from 2019-20 out of a total of

37 (48.6%). The Chi-squared analysis shows no significant association between the cluster and the group (academic year): $\chi^2 [1, n = 131] = .006, p = 0.94$.

Table 2. Descriptive statistics and analysis of differences by cluster

| | Cluster 1 (N=68) | | Cluster 2 (N=63) | | F | p | η^2p |
|-----------------------------|---------------------|------|---------------------|------|---------|-------|-----------|
| | M | SD | M | SD | | | |
| Satisfaction NPB (Z) | .642 | .683 | -0.533 | .686 | 96.863 | <.001 | .429 |
| Satisfaction NPB (Absolute) | 4.287 | .348 | 3.685 | .351 | 96.863 | <.001 | .429 |
| Frustration NPB (Z) | -.761 | .516 | .682 | .607 | 216.149 | <.001 | .626 |
| Frustration NPB (Absolute) | 1.493 | .274 | 2.259 | .322 | 216.149 | <.001 | .626 |
| Satisfaction Autonomy | 4.118 | .450 | 3.492 | .451 | 63.063 | <.001 | .328 |
| Satisfaction Competence | 4.250 | .457 | 3.611 | .553 | 52.224 | <.001 | .288 |
| Satisfaction Relatedness | 4.493 | .545 | 3.952 | .705 | 24.273 | <.001 | .158 |
| Frustration Autonomy | 1.467 | .518 | 2.444 | .656 | 90.246 | <.001 | .412 |
| Frustration Competence | 1.750 | .463 | 2.556 | .515 | 88.865 | <.001 | .408 |
| Frustration Relatedness | 1.261 | .307 | 1.778 | .490 | 53.153 | <.001 | .292 |

M: mean; SD: standard deviation

Positive and negative aspects in emergency virtual classes from the students' perspective

As can be seen in the statistical analysis, considerable levels of BPN satisfaction and low frustration levels were obtained in both years, with no difference between both types of class given. However, it seems interesting to study in greater depth the opinion of the students during the second year as regards face-to-face- versus virtual classes. In the face-to-face year (2019-20) students did not answer the open questions in the questionnaire. As they could be answered freely, they may not have felt obliged to answer them since the teacher had asked for their opinion in a free discussion in the last lesson of the training. However, in 2020-21 most of the students participated (it was the only way to get their opinions) and it helped us to understand their opinion on the change to virtual classes and specially

to obtain clues about the aspects that satisfied and frustrated the BPN.

Table 3 gives the number of quotations on the most positive aspects of the intervention. In "Pedagogical strategies" the most outstanding ones were: "the theoretical classes were interactive and the teacher gave us good exercises to make the classes dynamic" (S. 42); encouragement to reflect, "she proposed questions that made us think" (S. 25); the fact of considering their opinion, "many opportunities to speak" (S. 54); and agreement on different decisions, "teacher and students agreed on everything, everybody participated and nobody was caused to feel inferior at any time" (S. 46). The most frequently used adjectives were related to dynamism, interaction and participation, as found by determining their frequency by means of a word cloud.

Table 3. Positive aspects of the teaching received

| Code | Number of quotations 'Groundedness' |
|------------------------------------|--|
| Pedagogical strategies | 36 |
| Assessment strategies | 35 |
| (Technological) didactic tool used | 23 |
| Teacher's profile | 17 |
| Authentic assessment | 9 |
| Organization/structure of subject | 8 |
| Innovation | 3 |
| Relevance of contents | 3 |

"Continuous feedback between teacher and students" (S. 11) was among the most outstanding aspect of the "Assessment strategies", as well as feedback from classmates, "before handing in a project we got feedback from other groups" (S. 2). Also, student participation in assessment decision making, "we were asked about our opinion on our assessment" (S. 19), "the power we were given to convey our opinion and decide aspects of the evaluation" (S. 78); consensus, "create the evaluation all together" (S. 36). The most frequently used words were related to the participatory method, e.g. help, equals, continuous, other, group, opinion, as found by determining their frequency by means of a word cloud.

Interaction with students was reflected in the number of times it was mentioned (23). The adjectives describing this and other resources and dynamics were: practice, entertaining, dynamic, new, magnificent.

In "Profile of Agents", the teacher's profile stood out and obtained descriptions such as: profile/personality of the teacher, referring to her commitment, attitude, adaptive capacity, democratic and constructive profile, communication skills, interest for their needs, nearness and commitment, e.g. "The teacher is the key factor, the one who transmits. It is gratifying to be with someone who shows commitment and empathy towards the students she has taught" (S. 62). The word cloud reported: "pleasant, good, interested, close, enthusiasm, willing, communication, availability and positive".

Next, we show the codes generated by aspects of the subject that could be improved and that students "missed in online teaching" (table 4). Important aspects that could be improved include "No changes needed" (mentioned 21 times), which shows the high degree of satisfaction existing as for the training received.

Table 4. Aspects that could be improved in the training received in online teaching

| Code | Number of quotations 'Groundedness' |
|---|-------------------------------------|
| Lack of physical contact | 33 |
| Less interaction in class between the teacher and the groups | 28 |
| Virtual classes avoid direct relationship | 24 |
| No changes needed | 21 |
| Online classes require a greater effort | 11 |
| Online classes keep students apart | 10 |
| Explanations could be more precise | 7 |
| Not based on reality | 7 |
| The sequence could be better organized | 4 |
| More feedback required for online activities | 4 |
| Explanatory method | 4 |
| Lack of explanations | 4 |
| The lessons learned cannot be put into practice | 3 |
| More debates and the subject should be given deeper treatment | 2 |
| Too much information given at once | 1 |
| Better follow-up and feedback are needed | 1 |
| Should be considered as an independent subject | 1 |
| Problems with technological resources | 1 |
| Fewer students per class | 1 |
| Use of didactic resources | 1 |

Four codes emerged out of these aspects: "No face-to-face classes", "Organization of the subject", "Non-situated learning", and "Nothing to improve".

Inside the category "No face-to-face classes", some answers justified their opinion (from code with 28 quotations to code with 1 quotation in table 5), but many others had it implicit, hidden or explained it by simply saying "No face-to-face classes" (without further explanation) (33 comments).

Among the answers that were developed, some of the explanations that stand out include: less class interaction with teacher and between groups, and direct contact missing from online classes.

The aspects that could be improved in the training, therefore, were more related to the virtual format they were obliged to accept (groundedness = 107) (table 5) than with the organization of the subject (total of groundedness = 25)

(Table 6). However, it is important to point out the fact that some students indicated a lack of detail in the explanations, a poor organization of the sequence (structure) or the need to go deeper into the contents.

Table 5. Lack of face-to-face classes as a negative aspect of the training

| Code | Number of quotations 'Groundedness' |
|---|--|
| No face-to-face classes (not justified) | 33 |
| Less interaction in class with teacher and between groups | 28 |
| Online classes prevent direct contact | 24 |
| Online classes demand a greater effort | 11 |
| Online classes avoid contact with classmates | 10 |
| Problems with technological resources | 1 |
| TOTAL | 107 |

Table 6. Codes of aspects that need to be improved in "Organization of the subject"

| Code | Number of quotations 'Groundedness' |
|--|--|
| Needs more detail in orientations | 7 |
| Needs more feedback from online activities | 4 |
| Needs better organization of the sequences | 4 |
| Lack of explanations | 4 |
| Needs more debates and a deeper exploration of the topic | 2 |
| Should be considered an independent subject | 1 |
| Use of didactic resources | 1 |
| Needs more follow-up and feedback from classes | 1 |
| Fewer students per class | 1 |
| TOTAL | 25 |

Discussion

This study is based on the premise that the strategies involved in applying AfL were compatible with a teaching style that supports individual BPN. In spite of the large amount of evidence in education that shows that an autonomy support teaching generates diverse levels of autonomous motivation (Ryan & Deci, 2020), there was still no empirical evidence of the contribution of AfL-based-interventions on students' psychological needs satisfaction in PETE programs.

RQ1 responded to the contribution of an AfL-based intervention on students' BPNs. In both face-to-face (2019-20) and emergency virtual teaching (2020-21) high levels of BPN satisfaction plus low levels of frustration were achieved. Considering that both interventions were based on the AfL literature (Carless, 2017; Wiliam, 2018; Schellekens et al., 2021) for initial and ongoing training that supported autonomy (Su & Reeve, 2010; Aelterman et al., 2013), the study suggests, as in Holzer et al. (2021), Ryan & Deci (2020), Vansteenkiste et al. (2020), that a system that

supports these needs will generate intrinsic motivation and internalisation, which will increase achievement and especially the students' psychological welfare.

RQ2 aimed to study the differences in the satisfaction and/or frustration of BPN by applying AfL in face-to-face and emergency virtual teaching. The absence of significant differences between both groups indicates that the virtual strategies used in the year 2020-21 were just as effective as those used in face-to-face classes in 2019-20, which indicates the importance of the teaching strategies employed, more than a set of circumstances. In this case, as students highlighted (table 3), the technological tools and the interactive platform (Padlet) helped to support the teaching strategies already used in face-to-face classes and put them into action in the service of the learning goals and assessment, as recommended by the AIESEP (2020). It also gave some clues as to how these technologies generate commitment and learning (Ryan & Rigby, 2019) since they helped to maintain contact with students, favored continual feedback on the work carried

out and provided a positive perception of it, as in the study by Chen et al. (2021).

Likewise, there is a lack of association between the teaching conditions and the clusters. According to the descriptive analysis, there are no differences between the two academic years, with two clusters with similar profiles and the same percentage of students in each one. This could be linked to the fact that the same pedagogical design of the subject was maintained in both academic years as well as the use of technology to support the monitoring of learning during pandemics, as evidenced in the qualitative comments in table 3.

On the other hand, the identification of Cluster 2 shows how the same intervention strategies do not have the same effect on both groups of students, establishing two different profiles with more or less motivation, as found in previous studies (e.g. Cuevas-Campos et al., 2013; Moreno, et al., 2009). This is clear in the qualitative analysis in which there are also discrepancies, although positive feedback predominates.

When comparing both types of class (face-to-face and virtual), high levels of needs satisfaction were generated in both groups, unlike the findings reached in the study by Malinauskas and Pozeriene (2020), who found higher intrinsic motivation in the online group. In fact, it can be seen that the qualitative aspects that were evaluated more negatively by the students show their frustration referred to the lack of face-to-face classes and those that have to do with no direct interaction with the teacher and classmates (table 5). Relatedness support has been an important factor as in Chiu's study (2021). Among the negative aspects, the lack of a direct contact, especially in the context of Physical Education and Sports Degree where a closer contact in practical activities is regular, could become more relevant and can induce frustration and disappointment.

RQ3 aimed to identify positive and negative aspects of the intervention in emergency virtual learning from the students' perspective. The positive aspects refer to: pedagogical strategies that promote interaction between the participants (relatedness); the fact of giving voice to the students in classes and assessment (autonomy and competence); feedback on achievements (competence); a tool to facilitate and give them structure (e.g. Padlet); and the students' perception of having teachers that are interested and involved in the learning process.

Among the negative aspects related to virtual teaching, one can highlight the lack of structure, interaction and especially direct contact. Studies on this topic indicate that a classroom context that favors students' psychological progress also requires teachers that feel the satisfaction of the same needs (Ryan & Deci, 2020). Students in the present study perceived high motivation from their teacher and this somehow "infected" them and improved the expectations of both.

The results of the study support the idea that autonomy and giving a role to structure do not exclude each other (Jang et al., 2010; Vansteenkiste et al., 2020). Knowing the students' expectations, continual feedback and assignment structure were the keys to the success of the intervention, but the creation of a climate of dialogue and empathy that favored success and supported autonomy, giving voice to students when making decisions on the dynamics of the session and assessment also played an important role. As in previous studies that used self-assessment, peer-assessment and co-assessment (Lorente-Catalán & Kirk, 2014; Yin & Carless, 2021) or formative assessment (Granberg et al., 2021; Hawe & Dicson, 2017; Panadero, 2017), students were more committed and the learning process was more self-regulated, while the importance of formative assessment and feedback in online classes was confirmed (Chen et al., 2021).

Conclusions

This study has shown a high level of needs satisfaction in emergency virtual classes that used technological tools, which reinforces the need for further studies in which educational technologies can be created to generate commitment and learning. In this sense, future studies could confirm whether using these tools in face-to-face teaching has this effect on motivation as well.

It is also necessary to understand what happened in this intervention in this particular context which made it important to compare a normal (face-to-face) year and a completely unusual and uncertain one which consisted of emergency virtual classes. The circumstances of the pandemic caused serious changes in the universities' academic life. Face-to-face classes were generally impossible not only in one subject but in all university activities, so that the need for relatedness was especially frustrated and there was a clear need for autonomy and self-regulation to survive the situation.

Although this study contributes to scaling-up the empirical evidence of the contribution of AfL on BPN satisfaction, a lot of terrain remains to be explored on implementing AfL principles in educational contexts that support BPN. Doing this in the initial training of teachers should contribute not only to improving students' commitment and learning but also to increasing the assessment literacy they need for the significant change in beliefs and strategies of future teachers.

Acknowledgments

To the participants of the study: students of fourth year of CAFyD in the academic years 2019-20 and 2020-21.

Funding

This work was supported by the National Institute of Physical Education of Catalonia (INEFC).

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