

Examining temperament of physical education undergraduates

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Abstract:

Background and Study Aim: Temperament is a set of relatively consistent and stable traits that are related to emotions and formal characteristics of behavior. Temperamental traits are essential in both physical and athletic activities and help predict athletic performance and involvement in physical activity. Although research into temperament of athletes has been previously conducted, little is known about the temperament of physical education students. However, knowledge about temperamental traits can increase efficacy of physical education teaching and sports coaching. This study examines differences in temperamental traits between physical education (PE) and mechanical engineering (ME) students according to the regulatory theory of temperament.

Materials and Methods: A cross-sectional survey study was conducted at a large university in the south of Poland. The participants were 208 university students who were 19–40 years old ($M = 21.27$, $SD = 2.61$), including 83% of males ($n = 173$). The entire sample consisted of 106 PE undergraduates (51% of the total sample) and 102 ME students (49%). The FCB-TI self-report questionnaire in a standard “paper-and-pencil form was used to identify six temperamental traits, i.e., sensory sensitivity, endurance, emotional reactivity, activity, briskness, and perseverance. **Results:** The Student’s *t*-test revealed that PE undergraduates scored significantly higher in activity as a temperamental trait compared to ME students. No statistically significant differences between the groups were observed in sensory sensitivity, endurance, emotional reactivity, briskness, and perseverance. The mediation role of activity on the relationship between emotional reactivity and physical activity was found in this study. **Conclusions:** Activity level is crucial to explain the mechanism of how emotional reactivity determines engagement in physical exercise. Temperament should be considered in the PE curriculum as an important factor that determines healthy lifestyle, well-being, training effectiveness, and sport performance.

Key Words: Formal Characteristic of Behavior – Temperament Inventory (FCB-TI); Regulative Theory of Temperament (RTT); Individual differences; Psychology of sport and physical activity; University and college students

Introduction

Temperament as a psychological construct

Personality and temperamental traits are basic psychological constructs that can explain and predict human behavior in various domains of life, including physical activity. Temperament can be defined (Strelau, 2002) as a relatively consistent and stable tendency to behave (react) in a given way. Temperament is conceptualized in various dimensions. Among many concepts and theories of temperament, the regulative theory of temperament (RTT) seems to be the most promising for explaining and predicting human behavior. According to Pavlov’s typology, RTT temperament is understood as a formal (i.e., energetic and temporal) characteristic of behavior (Strelau, 1996). The structure of temperament consists of six following traits (Strelau, 2018): briskness (BR), perseverance (PE), sensory sensitivity (S), emotional reactivity (ER), endurance (EN), and activity (AC).

RTT assumes that behavior modification relies on the regulation of both the individual’s own activity and adjustment stimulative value of the environment to individual needs (Strelau, 1983). Activity is a regulator of need for stimulation. Because people differ in the level of arousability, individual differences in emotional reactivity determine the tendency toward chronically elevated or suppressed level of arousal. Using activity, individuals seek or avoid stimulation to achieve or maintain optimal level of arousal (Strelau & Zawadzki, 2012). Extroverted individuals with low emotional reactivity are resistant against stresses, and they prefer events with high level of stimulation. Introverts with high emotional reactivity try to avoid strong stimulation and are more prone to experience states of stress. If emotional reactivity is connected with unfavorable environment, a risk factor for developing behavior disturbances or pathology may be established (Strelau, 2018). This study examines the association between emotional reactivity and activity in university students of physical activity major.

Role of temperament in sport participation

The interaction between the stimulative value of sport's situation and reactivity may affect sport achievement (Strelau, 1988). The performance level decreases during highly stimulating and stressful situations in high reactivity individuals and decreases during very low stimulation (e.g., monotony or sensory deprivation) in low reactivity individuals. Temperamental traits are essential for adjusting athlete's behavior to environmental requirements. This process relies on the proper selection of a particular form of activity in the sport performance (Grigore et al., 2015; Rogowska, Wojciechowska-Maszkowska, & Borzucka, 2014; Sękowski & Berej, 2019; Shalar et al., 2019; Yuki & Atsushi, 2017).

The emotional reactivity level seems to be essential for both the preparation for competition during training and performance effectiveness. Emotional reactivity may contribute to the speed and accuracy of acquiring new skills and to the time and load of exercising or choosing a particular method. Temperament is strongly related to coping with stress, which is essential in sport achievement. Temperament is usually considered to be a moderator that modifies stressors, state of stress, and ways of coping with stress (Blecharz & Siekańska, 2007). Sports achievement also depends on discipline and participation in sports performance (Gracz & Sankowski, 2007). Recent studies (Unrug & Malesza, 2012) have indicated that athletes who are involved in professional martial arts exhibit higher sensory sensitivity and lower extraversion than those who recreationally participated in martial arts. Moreover, Magier and Magier (2015) have shown that the high level of activity and endurance and low emotional reactivity levels are associated with higher expectancy for achieving sports goals.

Temperament and personality traits seem to be especially important in extreme sport participation (Boldak & Guszowska, 2013; McEwan, Boudreau, Curran, & Rhodes, 2019; Monasteiro et al., 2016, 2018). Boldak and Guszowska (2013) have stated that people with low reactivity are attracted to extreme sports because such people have a broader spectrum of potentially optimal stimulation. A recent meta-analysis has shown that high-risk participants exhibit higher sensation seeking, extraversion, and impulsivity than low-risk sports participants or individuals who are not engaged in any sport (McEwan et al., 2019). A previous study (Laver, Pengas, & Meidan, 2017) evaluated high risk and severity of injury in some extreme sports. These parameters are related to such factors as athletes' temperament, particular epidemiology, and management of injury, treatment, and rehabilitation procedures. Temperament traits (e.g., perseverance, sensory sensitivity, and emotional reactivity) can even modulate pain sensitivity in combat sports athletes (Leźnicka et al., 2017).

Relationship between physical activity and temperament traits

Compared to sports activity, recreational physical activity is not strongly related to temperament and personality. Meta-analysis evidence showed a positive association between the activity facet trait of extraversion and physical activity (Allen & Laborde, 2014; Rhodes & Pfaeffli, 2012). Other temperamental traits showed ambiguous connections with physical activity. A study conducted among 515 Polish high school students revealed that temperament and personality traits were relatively poorly correlated with the adolescents' physical fitness (Guszowska & Rychta, 2007). In addition, Bernatowicz et al. (2015) did not identify a significant relationship between temperament and physical activity among non-athletes with the mean age of 21. Moderate to weak correlations were observed between particular temperament traits (related to RTT) and physical fitness components such as aerobic capacity, strength, agility, static–dynamic balance, and reaction time.

A longitudinal study (Jansen et al., 2017) indicates that childhood temperament may affect the formation of later physical activity habits, particularly in males. Males with a greater childhood temperamental activity level, higher intensity pleasure, and surgeons engaged in a more significant adolescent physical activity. This study did not identify an association between females' childhood temperament and later engagement in physical activity. More recent studies (Karvonen et al., 2020) have examined both temperament and personality characteristics at age 42 regarding physical activity frequency at age 50. Positive associations were identified between orienting sensitivity and overall physical activity and between extraversion and vigorous physical activity among women. In addition, low negative affectivity was correlated with overall and vigorous physical activity among men.

Purpose

Temperament traits affect how people behave and how they interact with other people within given circumstances. Although research on the relationship between temperamental traits and physical and sports activities has been widely conducted in recent years, little is known about physical education (PE) undergraduates as future PE teachers. Kirch et al. (2019) argued that students' personality is the central topic in the PE context, particularly with regards to planning and teaching PE lessons according to students' individual needs. Moreover, the development of student personality should be considered as an elementary goal of PE. A review study (Kirch et al., 2019) has indicated that extroverted students tend to enjoy PE more and obtain less anxiety in PE than more introverted PE students. However, the abovementioned review also showed that students' personality in PE depends on the personality theory, research questions, and results; therefore, the results are diverse. In particular, there is a lack of research on temperament traits in students from PE faculty.

This study investigates temperament traits among undergraduates studying PE compared to students of another faculty. Many PE students are engaged in sports activity at various levels of sports performance. Thus, it is not clear whether PE students share temperamental traits with athletes or rather they have traits that are typical of physically active individuals among the general population.

To our knowledge, this study for the first time examines the temperamental traits related to Strelau's RTT (i.e., emotional reactivity, briskness, activity, endurance, perseverance, and sensory sensitivity) among future PE teachers. By taking into account previous research on the relationship between temperament and sport participation (Grigore et al., 2015; Sękowski & Berej, 2019; Shalar et al., 2019; Yuki & Atsushi, 2017), temperament and engagement in physical activity of general population (Allen & Laborde, 2014; Rhodes & Pfaeffli, 2012; Bernatowicz et al., 2015; Jansen et al., 2017; Karvonen et al., 2020), and also the study performed among students from PE faculty (Kirch et al., 2019; Lodewyk, 2018), it is hypothesized that PE students exhibit higher activity and lower emotional reactivity than students from another faculty. Furthermore, the relationship between AC and ER is examined using mediation analysis. It is hypothesized that AC mediates the relationship between ER and PE.

Materials and methods

Participants

The participants were 208 undergraduates between 19 and 40 years of age ($M = 21.27$, $SD = 2.61$), including 83% of males ($n = 173$). The total sample consisted of second-year students who were divided into two groups, i.e., physical education students (PE students, $n = 106$, 51% of the total sample) and mechanical engineering faculty students (ME students, $n = 102$, 49%).

Procedure and measures

A cross-sectional study was performed at a large technical university in the south of Poland. The students anonymously and voluntarily completed the "paper and pencil" Formal Characteristic of Behavior – Temperament Inventory (FCB-TI) during didactic classes at the university, with lecturers' consent. Students signed the consent form before completing the questionnaire. Institutional review board approval was obtained for the study procedures for recruitment, data collection, and analysis.

Temperament traits were assessed using a standard 'paper and pencil' type self-report questionnaire. According to RTT, developed by Strelau (1996, 2002), temperament refers mainly to the formal aspects of behaviour such as energetic and temporal characteristics. Temperament traits were assessed using a standard 'paper and pencil' type self-report questionnaire. Each scale comprises 20 items, with "yes" or "no" answers. The Polish version of FCB-TI (Zawadzki & Strelau, 1997) revealed good reliability for the following scales: briskness ($\alpha = .77$), perseverance ($\alpha = .79$), sensory sensitivity ($\alpha = .73$), emotional reactivity ($\alpha = .83$), endurance ($\alpha = .85$), and activity ($\alpha = .83$). In this study ($N = 208$) internal reliability (Cronbach's α) was acceptable for briskness ($\alpha = .62$), perseverance ($\alpha = .79$), sensory sensitivity ($\alpha = .76$), emotional reactivity ($\alpha = .82$), endurance ($\alpha = .79$), and activity ($\alpha = .80$).

Statistical Analysis

The reliability (Cronbach's α) of FCB-TI scales was evaluated in the first statistical analysis step. Descriptive statistics (including mean, standard deviation, and Pearson's r coefficient to calculate the correlation between particular scales of FCB-TI) were used to summarize the data representing the total sample. The differences between PE and ME samples were assessed using Student's t -test of an independent sample with the p -value of 0.05 (5%) as an acceptable level of validity and Cohen's d coefficient to calculate the effect size. Regression and mediation analyses were used to clarify the relationship between physical activity as a dependent variable, and two temperamental traits (emotional reactivity and activity) were used as an independent variable. The mediation model was tested using PROCESS 3.3. Macro for SPSS 25.36,37. The conditional effect was tested on a bias-corrected bootstrapping procedure with 5000 samples. A bootstrap confidence interval (95% CI), which does not include the "0" value, indicates a significant effect. All statistical analyses were performed using the STATISTICA 13.1 software.

Results

Descriptive statistics are shown in Table 1. The entire sample ($N = 208$) obtained the lowest scores in emotional reactivity and the highest scores in briskness. A moderate correlation was observed between emotional reactivity and perseverance, emotional reactivity and endurance, and endurance and briskness. The other variables correlate weakly with each other except for two non-significant correlations between emotional reactivity and sensory sensitivity and between perseverance and activity.

Table 1. Descriptive statistics for particular scales of FCB-TI in the total sample ($N = 208$)

Scales of FCB-TI	<i>M</i>	<i>SD</i>	SS	AC	PE	BR	EN
Sensory Sensitivity (SS)	15.14	3.34					
Activity (AC)	12.68	4.26	.22***				
Perseveration (PE)	11.93	4.18	.20**	-.02			
Briskness (BR)	16.33	2.58	.21**	.30***	-.17*		
Endurance (EN)	12.25	4.40	.14*	.17*	-.29***	.44***	
Emotional Reactivity (ER)	7.26	4.36	-.13	-.27***	.49***	-.38***	-.46***

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

The differences between independent samples are shown in Table 2. Significant differences were observed in the activity scale of FCB-TI, with a medium effect size. These differences are shown in Fig. 1. Although the p -value is not sufficiently significant ($p < .10$), a small effect size (Cohen's d) is observed in briskness and endurance scales.

The results of regression analysis indicated that AC completely mediated the relationship between ER and PE. Bootstrap results for the regression effect of ER on AC are $\beta = -.26$, Boot SE = 0.07, and Boot CI = [-0.40, -0.12]. Direct and indirect effects of ER on PA are on a log-odds metric. The direct effect of ER on PA is $\beta = 0.01$, SE = 0.04, CI = [-0.06, .07]. The indirect effect of ER on PA for AC as a mediator equals $\beta = -0.04$, Boot SE = 0.01, Boot CI = [-0.07, -.01].

Table 2. Differences in temperamental traits between PE and ME samples

Scales of the TCB-TI	PE ($n = 106$)		ME ($n = 102$)		$t(206)$	p	d
	M	SD	M	SD			
Sensory Sensitivity	15.22	3.02	15.06	3.67	0.34	.734	.05
Activity	13.85	3.58	11.46	4.58	4.20	.000	.58
Perseveration	11.69	4.33	12.18	4.03	-0.84	.402	.12
Briskness	16.66	2.34	15.98	2.77	1.91	.057	.27
Endurance	12.76	4.45	11.73	4.30	1.71	.089	.24
Emotional Reactivity	6.98	3.95	7.55	4.74	-0.94	.349	.13

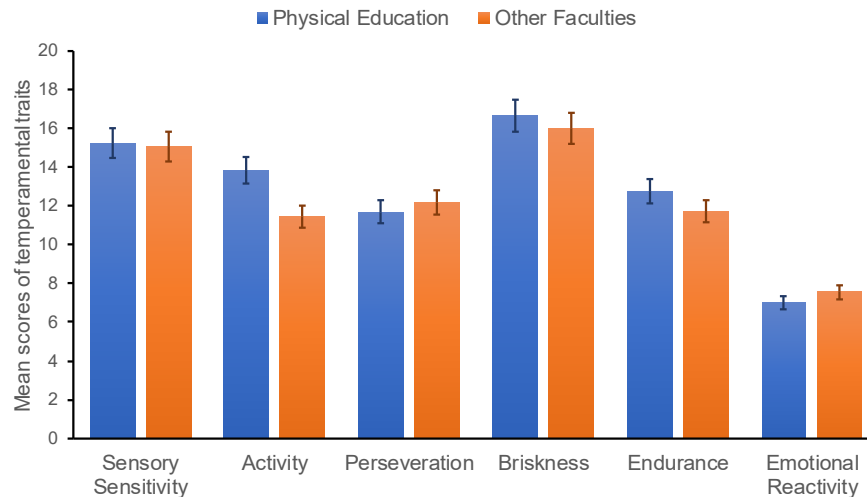


Figure 1. Mean scores of temperamental traits ($N = 208$) in PE and ME samples of undergraduates. Error bars represent the 95% confidence interval (CI). *** $p < .001$.

Discussion

The purpose of this study was to examine differences in RTT traits (i.e., sensory sensitivity, activity, perseveration, briskness, endurance, and emotional reactivity) between PE and ME university students. The hypothesis about higher emotional reactivity was not confirmed in this study, which is not consistent with previous studies (Bernatowicz et al., 2015; Jansen et al., 2017; Karvonen et al., 2020; Kirch et al., 2019; Sękowski & Berej, 2019). Sękowski and Berej (2019) determined that athletes who represented both team and individual sports were characterized by a higher level of endurance and activity and a lower level of emotional reactivity and perseveration (compared to the general population). In previous studies (Jansen et al., 2017; Karvonen et al., 2020), emotional reactivity was one of the most important traits for predicting physical activity and sport achievement. In addition, extraversion (which is related to low reactivity) was the most characteristic trait of PE students' personality (Kirch et al., 2019).

In this study, the lack of significant difference between PE and ME students may be due to the ME students sample's specific characteristic because low emotional reactivity was observed in both PE and ME samples of undergraduates. There is evidence that students from different faculties may have different temperament traits (Pawelczyk, Rabe-Jabłońska, Pawelczyk, 2010). Pawelczyk et al. (2010) have determined that medical faculty students are characterized by lower emotional reactivity and perseveration compared to people in the same age range and same-sex couples in the general population. Thus, it is possible to assume that ME students are characterized by the low level of emotional reactivity.

This study indicates that among the six traits of FCB-TI's temperament, only activity differentiates PE and ME students. PE students have a higher level of activity than ME students. According to the curriculum, PE students attend numerous classes that require commitment to physical activity. Many PE students engage in

academic sports; therefore, their level of physical activity is higher than that of average students who may be recreationally involved in physical exercise. This result is consistent with that in most previous studies conducted under the context of both physical activity and sport participation (Allen & Laborde, 2014; Bernatowicz et al., 2015; Jansen et al., 2017; Rhodes & Pfaeffli, 2012; Sękowski & Berej, 2019). A review of scientific literature indicated that activity was the main trait of extraversion and was related to physical activity in the general population (Allen & Laborde, 2014; Rhodes & Pfaeffli, 2012). In addition, Jansen et al. (2017) showed that the activity level in early childhood may contribute to physical activity in adolescence. The temperament activity trait was positively related to simple and complex reaction times in the Polish population (Bernatowicz et al. 2015).

Activity seems to be also essential in the field of sports participation. Among six traits of temperament related to RTT, Sękowski and Berej (2019) determined that the only statistically significant difference between athletes in individual and team disciplines was in their activity level. Athletes who engaged in team sports demonstrated heightened activity compared to individual sports participants. Of note, the general level of activity was higher in both team and individual sports athletes than that in the general population. Although many factors may affect effective PE teaching (Kuśnierz, Zmaczyńska-Witek, & Rogowska, 2020; Pavlyuk et al., 2018), personality and temperament traits seem to be most promising (Lodewyk, 2018; Shalar et al., 2019; Vescan & de Hillerin, 2017; Yuki & Atsushi, 2017). Lodewyk (2018) observed a relationship between negative affect, victimization, and dimensions and facets of personality traits in physical education. Students who are prone to negative affect during physical education classes tend to be more emotional and introverted. There is evidence that psychological factors (e.g., temperamental types) can underlie the internal motor regulation of an individual (Vescan & de Hillerin, 2017). Vescan and de Hillerin (2017) have identified choleric, sanguineous, phlegmatic, and melancholic temperamental types using the graphical analysis of neuro-motoric control in a predetermined motoric task. This experiment confirmed the relationship between temperament and motor activity. Indeed, Shalar et al. (2019) have confirmed that the relationship between the physical qualities of young gymnasts and their individual differences in personality and temperament may facilitate or handicap sports success. Personality traits of athletes also contribute to their resilience in various day-to-day life situations and during competitive situations (Yuki & Atsushi, 2017).

High activity level refers to the need to move all the time, explore the environment, and seek stimulation (Strelau, 2018). Higher levels of activity are related to better physical and mental health and also to a healthier lifestyle (Bojanowska & Zalewska, 2018; Craft & Landers, 1998; Gill et al., 2013; Rodríguez-Fernández et al., 2017; Strelau, 2018; Strelau & Zawadzki, 2011; Turkmen et al., 2013). People who like physical activity can benefit from this behavior's pleasure and enjoyment (Jansen et al., 2017), which may protect them from burnout, depression, and lower quality of life (Allen & Laborde, 2014).

Overall, the strength and direction of correlations between particular scales of FCB-TI are similar to the previously observed relationship, which seems to be consistent with RTT (Strelau, 1988, 1996; Zawadzki & Strelau, 1997). To our knowledge, this study for the first time determined the mediation role of AC on the relationship between ER and PA. It is essential to explain the mechanism of how ER determines engagement in exercise or sport. The results of this study showed that low ER could not predict the level of involvement in PA without heightened AC. Those individuals with heightened ER, who demonstrate concurrently low AC, may meet the need for stimulation by sedentary behaviors such as watching TV, reading books, computer gambling, social media use, Internet shopping, or other activities related to IT technologies. In this study, ME students seem to fulfill this assumption.

Temperament greatly affects the subjective well-being and perception of the quality of life related to mental and physical health or illness (Strelau, 2018). It has been determined (Strelau & Zawadzki, 2011) that emotional reactivity, perseverance, and briskness are significantly related to neuroticism and fearfulness in the form of an anxiety trait. High emotional reactivity is also associated with an anxiety disorder and post-traumatic stress disorder (PTSD; Rzeszutek et al., 2015; Strelau & Zawadzki, 2011). Higher perseverance and emotional reactivity are associated with higher depressive symptoms (Hintsä et al., 2016). On the other hand, higher briskness, endurance, and activity may decrease the risk for depressive symptoms. Overall, the obtained results indicate that higher endurance and lower perseverance and emotional reactivity seem to be health-protective temperament characteristics that reduce the risk of depressive symptoms.

Bojanowska and Zalewska (2018) showed that higher subjective well-being (SBW) is related to higher briskness, endurance, activity, and lower perseverance and emotional reactivity. The higher positive effect was associated with energetic regulation dimensions (i.e., higher endurance and activity and lower emotional reactivity) and higher perseverance, whereas the heightened negative effect was predicted by higher emotional reactivity, lower briskness, and higher perseverance. In addition, higher satisfaction with life was related to lower emotional reactivity and higher activity.

Numerous studies have indicated that physical activity and exercise are strongly related to the quality of life and subjective perception of well-being both in physical and psychological health (e.g., Gill et al., 2013; Rodríguez-Fernández, Zuazagoitia-Rey-Baltar, & Ramos-Díaz, 2017). Grześkowiak and Siwy-Hudowska (2016) have shown that the subjective assessment of women's quality of life increases with a decrease in dissatisfaction as a temperamental feature and in the presence of physical activity. Physically active women demonstrated lower

dissatisfaction as a temperament feature compared to physically inactive women. Higher amounts of regular exercise activity are generally related to more positive affective responses, and both variables are strongly influenced by genetic factors (Schutte et al., 2017).

The strong connection between quality of life and temperament is based on the association between temperament and stress (Strelau, 2018). Blecharz and Siekańska (2007) have investigated the relation between temperament, structure, and ways of coping with stressful situations among professional soccer and basketball players. The abovementioned study determined that emotion-oriented coping could be predicted by low briskness, endurance, sensory sensitivity, high perseveration, and emotional reactivity. Avoidance-oriented coping is related to high activity, whereas task-oriented coping style negatively correlates with emotional reactivity and is positively associated with briskness and endurance. Positive personality traits (e.g., hope, optimism, perseverance, and resilience) can also improve coping with stress among athletes and sports coaches (Laborde, Guillén, Watson, & Allen, 2017). The obtained results indicate that perseveration is an essential trait for emotional calming and active planning strategies for coping with stress. Athlete's psychological preparation is aimed at the optimal use of his/hers psychological and physical potential including personality and temperament traits, environmental factors, tactical plan, and cooperation skills. Blecharz and Siekańska (2012) suggest to diagnose temperament during individual mental training preparation of world-class athletes.

This study has some limitations. First, this cross-sectional study cannot conclude the causal relationship between university students' temperament and faculty. It is advisable to perform longitudinal studies in the future. Second, the sample size was not large. In the future, a larger sample representing various faculties of the university should be included in the study. In addition, the group of participants should be more balanced in the future in terms of gender. Despite the abovementioned limitation, for the first time, temperamental traits were investigated among PE students, which may be the strength of this study. Because temperament significantly contributes to the effectiveness of sporting results, coping with stress, and improving subjective well-being, it is essential to continue to study temperamental traits in PE students who will shape their students' behaviour as prospective teachers.

Conclusion

Higher activity in PE undergraduates as future PE teachers is a good trait for promoting a healthy lifestyle and health prevention in the pupils. The knowledge about temperamental traits should be used in PE curriculum to improve training and sports performance effectiveness of schools' physical and sports activities. In particular, PE teachers should use the knowledge about students' temperament to individualize methods regarding activity as a temperamental trait. Pupils with the heightened need for activity should participate in higher intensity PE training than pupils with low activity. It is also possible that students with low activity levels need higher motivation and increased encouragement to join EP classes.

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