Sports Psychology

Behavioral engagement and intention to be physically active among Brazilian adolescents: a self-determination theory approach

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Abstract - Aim: The experience that students have in physical education class is fundamental to promote an active lifestyle. The aim of this work was to test a predictive model of behavioral engagement and intention to be physically active among physical education students from the self-determination theory in the Brazilian context. **Methods:** For this purpose, a total of 414 adolescents between 12 and 16 years old participated in the study by answering several previously validated questionnaires. The findings of this study confirmed the hypothesis that the satisfaction of each of the basic psychological needs (autonomy, competence and relatedness) would be positively associated with each of the autonomous regulations (intrinsic motivation, integrated regulation and identified regulation) and these, in turn, would be positively related to behavioral commitment and the intention to be physically active. **Results:** The results of this work show the importance of generating a positive motivational climate in the physical education classroom both to improve students' involvement in class and to favor their intention to be physically active. **Conclusion:** The results are discussed considering the mechanisms that explain the role of the different basic psychological needs and motivational regulations on behavioral patterns.

Keywords: self-determination theory, physically active, physical education, behavioral commitment, teenagers.

Introduction

One of the most relevant objectives of Physical Education is to raise awareness about the importance of the physical activity practice, bringing singular knowledges and experiences, collaborating for the adoption of responsible acts for the regular physical activity[1-7]. Therefore, school P.E. classes must constitute in special moments for the adoption of an active lifestyle, first of all, in a motivational and immersive way for students. By contrast, if adequate conditions are not established, the negative experiences during P.E. classes may affect directly this proposition. Consequently, the students' physical activity level[9], in a short or long prompt of the regular practice[10].

An interesting point of view to this diagnosis would be to investigate the intention expressed by children and teenagers to sports practice, physical exercises or physical activities can be a good indicator of one's motivation, as well as a strong predict of one's future behavior[11], based on what is exposed by the Theory of Planned Behavior[12].

By this perspective, the association study between many emotional variants and the practice intention[13] was developed considerably throughout the last years by two of the most relevant Motivational Theories, such as: Goal-Setting Theory[14,15] and the Self-Determination Theory[16].

The importance of the motivational processes and its influence in the physical activity practice has been demonstrated in many international researches[17-20], also to explain positive behaviors and attitudes for physical activity practice outside school[13,21].

Precisely, studies about the intention to be or become physically active conceive many indicators about future behaviors connected to the practice of P.E. classes on obligatory education, once concluded[13,17,22]. By counterpart, promoting students' compromise became an "key" matter for P.E. teachers and researchers[23].

There are many evidences that the intention to be physically active such as the students' compromise can be affected by motivational processes related to P.E. classes[24,25,26]. The Self-Determination Theory (SDT)[27]

explains the mechanisms of association between motivation and the students' compromise in classes[25]. Compromise has been approached as a multidimensional construct[28], made by cognitive, behavior and emotional aspects.

Since the behavior aspect of a student is related by one's commitment and persistence during activities in the educational process; the cognitive aspect is related to the perception of one's competence and autoregulation strategies; and the emotional aspect is reflected on the attitudes, interests and appreciation of the educational process.

The Self-Determination Theory (SDT) gives special importance to different kinds of motivation, distinguishing between autonomous motivation, constituted by intrinsic motivation and the motivations (integrative and identified); controlled motivation formed by introjected and external regulations; and demotivation.

Accordingly to the SDT, intrinsic motivation reflects the individual's commitment on an activity by the pleasure that it produces, without necessity of external incentives. It is the most desirable and long-lasting kind of motivation, related to many adaptive behavior variables[29].

As in the identified regulation the individual tends to understand the importance of the activity for himself/herself and recognizes it consciously as beneficial to his/her personal development, in a way that all behaviors are autonomous, although the decision to reach them is determined by a series of external benefits, not because of the pleasure related to the activity itself.

Integrative regulation manifests when the identified regulations are completely assimilated by the subject, who evaluates them and acts according to one's values and necessities. Although it is still a way of extrinsic motivation assuming that it is not attended by the inherent pleasure to one's self activity[30,31].

Furthermore, SDT address that there are some psychological, basic and universal necessities, who motivate human behavior. Those are: autonomy, competence and relations with other human beings[32].

A student who feels autonomous when must decide certain aspects of one's educational process, normally it is because the teacher provides them more responsibilities, favoring one's interests and preferences[33]. Competent students feel capable and successful on the developed tasks during the educational process.

Thus, the necessity of relation with fellows suggests that students must feel connected with their teacher, colleagues and school. Each one of those three basic and universal necessities are important for quality experiences and development. Satisfying those necessities will positively influence intrinsic motivation[32].

This postulate from SDT was corroborated and supported by many studies realized in many aspects of Physical Education who demonstrated by unanimity significative satisfactory autonomy relations[34] and competence[35] with intrinsic motivation, appearing with less frequence on the association between the relations with others and the intrinsic motivation[36,37].

Objective and justification

In Brazil, there are, still, not many researchers who compromised to research deeply the intention of the physical activity of the students from P.E. school classes, linked to the SDT.

Therefore, the objective of this work is to test a predictive model of behavioral commitment and intention to be physically active in physical education students.

According to the hypothesized model, the satisfaction of each of the basic psychological needs (autonomy, competence, and relationship) would be positively associated with each of the autonomous regulations (intrinsic motivation, integrated regulation, and identified regulation) and these, in turn, would be positively related to behavioral commitment and the intention to be physically active.

Thus, this study not only highlights the issue but also leads to the debate regarding Health in P.E. school classes, guided by the Self-Determination Theory. In this perspective, it aims to inspire new research in this still incipient production scope, as, through its data and analysis, to become able to collaborate in the teachers' training and the constitution of more motivating classes, therefore, more significative for students.

Methods

Participants

Participated in this research 414 students from 10 public schools located in the city or São Paulo, Brazil, linked to the Department of Education of the State of São Paulo, divided into 8 Education Boards, East 1 (1 school), East 3 (1 school), East 5 (2 schools), South 3 (2 schools), North 1 (1 school), North2 (1 school), MiddleSouth (1 school), Midwest (1 school).

The students were students from 7th to 8th grade of elementary school II, final years of elementary school, with an average age of 13 years.

Measures

Basic psychological needs in PE

To measure students' perception of the three basic psychological needs in PE, the Brazilian version adapted to PE[38] from the Basic Psychological Needs in Exercise Scale[39] was utilized.

The instrument is headed by the statement: "In my PE classes…". It includes 12 items that, grouped into 4 items per factor, measure autonomy (e.g., "I feel that the way PE is taught is the way I would like"), competence

(e.g., "I feel that I improve even on the tasks considered difficult by most children"), and relatedness (e.g., "I feel like I have a close bond with my classmates").

Items were scored on a 5-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). In this study, confirmatory factor analysis (CFA) showed a good fit with the observed data: χ^2 (df = 51) = 127.75, $p < 0.001$, χ^2/ df = 2.49; CFI = 0.96; TLI = 0.95; SRMR = 0.060; RMSEA = 0.060.

Autonomous forms of motivation in PE

To assess students' perceptions of intrinsic motivation, integrated and identified regulation toward PE, the three subscales measuring these dimensions from the Brazilian version[40] of the Perceived Locus of Causality Questionnaire[41] were utilized.

They are headed by the statement "I participate in PE classes…". A total of 4 items are used to judge each of the subscales; intrinsic motivation (e.g., "Because PE is exciting"), integrated regulation (e.g., "Because I consider that PE is part of me") and identified regulation (e.g., "Because it is important for me to do well in PE") and rated using a 5-point Liker-type scale from 1 (strongly disagree) to 5 (strongly agree).

In the present study, CFA revealed acceptable fit indexes: χ^2 (df = 51) = 107.39 $p < 0.001$, χ^2/ df = 2.11; CFI = 0.97; TLI = 0.96; SRMR = 0.038; RMSEA = 0.052.

Intention to be physically active

To judge the students' perception of intention to be physically active, the Brazilian version[42] of the Intention to be Physically Active Measure[43].

The unidimensional instrument is headed by the statement "Regarding my intention toward sport/ physical activity…" and followed by 5 items (e.g., "I often do sport in my free time"). Each item is scored on a 5-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree).

In this study, CFA reported suitable goodness-of-fit measure: χ^2 (df = 5) = 24.69 $p < 0.001$, χ^2/ df = 2.11; CFI = 0.97; TLI = 0.95; SRMR = 0.037; RMSEA = 0.075.

Engagement in PE

Students' behavioral engagement was assessed using an adapted and translated version of the dimension of behavioral engagement included in the instrument designed by Shen et al. to measure students' perceptions of their report, attention, and persistence in PE classes.

The stem used in the questionnaire was "When I am in PE classes…", and it was followed by five items grouped in a single dimension (e.g., "I listen to the teacher very carefully"). The responses were provided on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

The results of the CFA carried out with this study sample yielded adequate model goodness of fit indices: c^2 (df = 5) = 26.98 $p < 0.001$, c^2/ df = 5.40; CFI = 0.95; TLI = 0.94; SRMR = 0.053; RMSEA = 0.069.

Procedure

After the research was approved by the Ethical Committee, with the ICF (Informed Consent Form) number 2.549.334, authorized by São Paulo's Secretary of Education, the researcher got in touch with the schools, then, after authorized by the schools' principals, the teachers first answered the online quiz, then the students.

The questionnaires were applied to the students by the researcher in a room, with a 20-40 min time range. All participants were treated in agreement with the ethical guidelines of the American Psychological Association with respect to consent, confidentiality and anonymity of their answers.

The researcher, initially, presented herself to the students, delivered the questionnaires, did a previous reading, explained how it should be answered, then, when necessary, answered questions.

Data analysis

Before main analyses, screening of data was performed, detecting three cases were detected as univariate outliers (i.e., Z scores higher than 3) and ten cases as multivariate outliers (i.e., Mahalanobis d2 at $p < 0.001$).

All these cases were removed and the final sample was made up of 414 participants. To analyze reliability of the target variables, Cronbach's alpha was estimated for each variable, which is acceptable when values are over 70[44].

To inform descriptive statistics, mean scores together with standard deviation, skewness and kurtosis were computed for every variable.

Taking into consideration the need of a ratio of at least 10 cases by each parameter to be estimated in order to guarantee the trustworthiness of results,[45] the hypothesized relationships in the proposed theoretical model was analyzing through the specification of a path analysis with manifest variables (ratio 414 cases/40 parameters).

In addition, the hypothesized model was controlled for gender and age given that the motivational processes involved in PE may vary depending on both variables[46]. For this analysis, the maximum likelihood method together with the 5000-resampling bootstrapping technique were applied due to the data failed to follow a normal distribution (Mardia's coefficient = 14.52, $p < 0.001$) (Kline, 2016).

To assess the goodness of the model's fit, a combination of fit indexes was utilized: coefficient between χ^2 and degree of freedom (χ^2/df) comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA) together with its confidence interval at 90% (90%CI).

Values as high as 5 for the χ^2/df coefficient, values greater than .95 for CFI and TLI accompanied by values up to .050 for SRMR and RMSEA are representative of a good fit to data[47]. To inspect direct and indirect effects, the methodological proposal described[48] was followed.

An indirect effect is significant ($p < 0.005$) when its confidence interval at 95% (95%CI) does not include the zero value.[49] Indirect effects and its 95%CI were calculated by the bootstrapping strategy. Data were statistically analyzed using IBM® SPSS® Statistics (version 23.00) and AMOS® (version 23.00).

Result

Descriptive statistics, reliability coefficients and correlations among variables

Table 1 shows that every variable under study obtained mean scores above the mid-point of its respective measurement scale. Reliability analysis found suitable values with Cronbach's alpha between .71 and .81.

Moreover, there were positive and significant correlations among the target variables, which ranged from 0.29 to 0.72.

Path analysis

The hypothesized model obtained a good fit to the observed data: χ^2 ($df = 5$) = 12.12, $p = 0.033$, $\chi^2/df = 2.45$; CFI = 0.99; TLI = 0.96; SRMR = 0.015; RMSEA = 0.049. Figure 1 displays that, after controlling for gender and age, autonomy, competence and relatedness positively predicted intrinsic motivation (β = 0.16, $p < 0.001$; β = 0.36, $p < 0.001$; β = 0.20, $p < .001$), integrated regulation (β = 0.25, $p < 0.001$; β = 26., $p < 0.001$; β = 0.17, $p < 0.001$), and identified regulation (β = 0.13, $p = 0.007$; β = 0.38, $p < 0.001$; β = 0.15, $p = 0.001$).

Likewise, the three autonomous forms of motivation positively predicted PE commitment (β = .14, $p = .028$; β = 0.08, $p = 0.039$; β = 0.30, $p < 0.001$) and intention toward PA (β = 0.13, $p = 0.028$; β = 0.33, $p < 0.001$; β = 0.12, $p = 0.025$).

In addition, competence directly and positively predicted PE commitment (β = 0.31, $p < 0.001$) and intention toward PA (β = 0.19, $p < 0.001$), as see in Figure 1.

Regarding indirect effects, the three autonomous forms of motivation significantly mediated the associations of autonomy (total indirect effects: β = 0.05, 95%CI = 0.01 - 0.10, $p = 0.038$; β = 0.12, 95%CI = 0.07 - 0.18, $p = 0.006$), competence (total indirect effects: β = 0.15, 95%CI = 0.09 - 0.21, $p = 0.011$; β = 0.18, 95% CI = 0.13 - 0.24, $p = 0.007$) and relatedness (total indirect effects: β = 0.07, 95%CI = 0.02 - 0.11, $p = 0.015$; β = 0.10, 95% CI = 0.05 - .17, $p = 0.005$) with intention to be physically active and PE commitment, respectively.

Table 1 - Anthropometric, clinical, strength, and hemodynamic values from a woman with Chagas Cardiopathy measured at baseline (T1), three (T3), and six (T6) months after 24-week combined physical training.

Characteristics	T1	T3	T6
Anthropometric			
Body mass (kg)	85.7	84.4 (-1.51%)	83.4 (-2.68%)
BMI (kg/m^2)	33.5	33 (-1.49%)	32.6 (-2.68%)
SBP (mmHg)	150	100 (-33%)	120 (-20%)
DBP (mmHg)	90	70 (-22%)	80 (-11%)
MBP (mmHg)	110	80 (-27%)	87 (-21%)
Percentage body fat (%)	37.5	35.7 (-4.8%)	33.1 (-11.7%)
WHR (cm)	0.84	0.80 (-4.7%)	0.79 (-5.9%)
Cardiopulmonary exercise test			
At rest			
VO_2 absolute (L/min)	0.04	0.02 (-50%)	0.07 (+75%)
VO_2 relative (mL/kg/min)	0.47	0.24 (-51%)	0.84 (+79%)
VAT			
VO_2 absolute (L/min)	0.63	0.53 (-15.8%)	0.57 (-9.5%)
VO_2 relative (mL/kg/min)	7.41	6.31 (-14.8%)	6.87 (-7.2%)
Time (s)	146	324 (121%)	321 (119%)
Load (watts)	40	65 (62.5%)	65 (62.5%)
Peak			
VO_2 absolute (L/min)	1.2	0.85 (-29%)	0.89 (-26%)
VO_2 relative (mL/kg/min)	13.7	10.12 (-26.2%)	10.72 (-22%)
Time (s)	480	624 (30%)	612 (27.5%)
Load (watts)	95	115 (21%)	115 (21%)
Ventilatory efficiency (VE/VCO_2 *Slope.*)	26.25	21.99 (-16.2%)	18.27 (-30.4%)
1-MR Test			
Squat (kg)	62	76 (22.5%)	82 (32.2%)
Wide-grip pull-up (kg)	45	48 (6.6%)	52 (15.5%)

BMI: body mass index; DBP: diastolic blood pressure; MBP: mean blood pressure; SBP: systolic blood pressure; WHR: waist-to-hip ratio. VO_2: oxygen consumption; VE/VCO2 *Slope:* ventilatory equivalents of carbon dioxide; VAT: ventilatory anaerobic threshold; 1-MR: one maximum repetition. The values in parentheses represent percentage increases or decreases comparing T1 x T3 e T1 x T6.

Discussion

The objective of this study was to test an explanatory model of adolescents' behavioral commitment and intention to be physically active, considering the satisfaction of basic psychological needs and the autonomous motivation of these students as predictor variables (Figure 1).

The results showed that the satisfaction of autonomy, competence, and relationship with others was positively

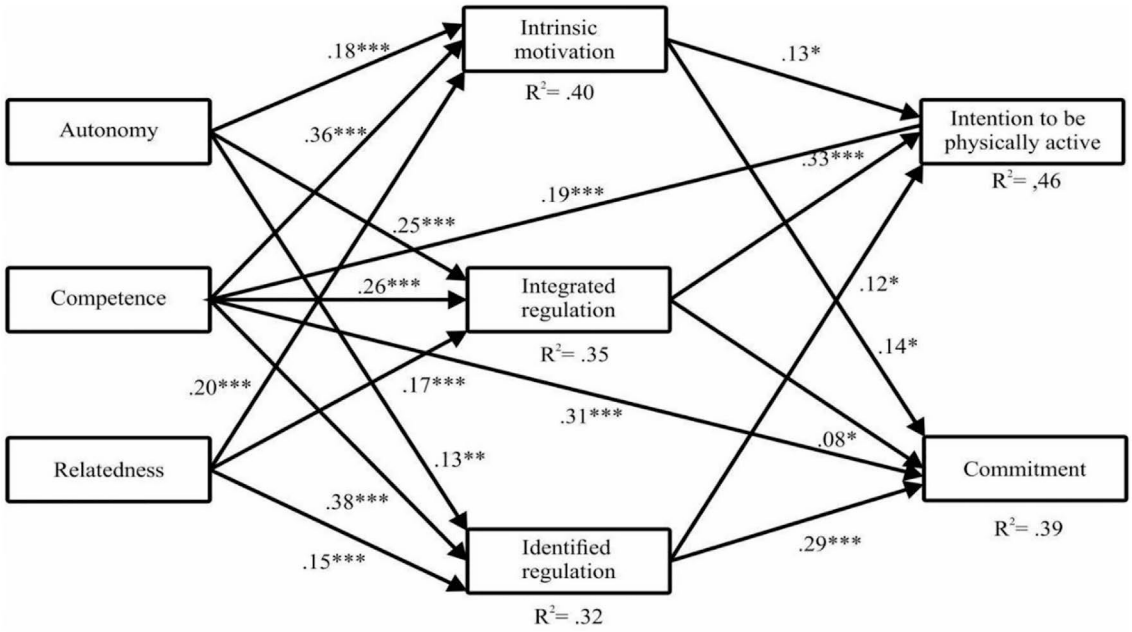

Figure 1 - Structural model predicting intention to be physically active and students' engagement from a self-determination perspective

related to intrinsic, integrated and identified motivation. The discussion will be structured in three subsections with the aim of clearly presenting the most relevant findings of this work.

In the first section, the general contributions of the results found in this work will be discussed with the existing literature.

The second section will be dedicated to the relevant role of competence satisfaction in motivational processes and in the behavior of the latter.

Finally, in the third section, the specific contribution of having analyzed the three regulations that make up autonomous motivation independently will be discussed, focusing on integrated regulation as an important tool in improving adaptive behaviors in contexts of physical activity.

Prediction of behavioral commitment and intention to be physically active from the prism of self-determination theory

Previous studies[24,26], had found that the satisfaction of basic psychological needs in physical education students was positively related to their autonomous motivation.

Although the vast majority of studies coincide in indicating satisfaction of the needs for autonomy and competence as predictors of motivation, the role of the need for a relationship seems to be less clear.

Vasconcellos et al.[50] have suggested that, while the role of the teacher seems to foster motivational experiences through the perception of competence and autonomy, satisfaction with relationships with others is more influenced by relationships with peers.

In line with this idea, the findings of the study[26] could suggest that the role of the PE teacher is more important than that of peers when it comes to promoting intrinsic motivation in this context. Recently, it has been suggested that relationship satisfaction with others could act as an antecedent of autonomy and competence satisfaction[51].

In this study with a Brazilian population, on the contrary, the relationship does seem to be important. Therefore, in this case, it seems that the relationship with others favors the intrinsic motivation of two students.

This could be due to cultural and behavioral aspects, for example and it would be interesting for future studies to investigate the behavior of this variable in the context of P.E.

The importance of competence satisfaction

Previous studies have shown that the satisfaction of the need for competence is the most determining factor in the prediction of adaptive motivational and behavioral patterns. In this line, the study[25] pointed out that both the satisfaction and the frustration of the need for competition affected the autonomous motivation of physical education students.

In this same study, the frustration of autonomy and relationship needs was not significant in the explanation of autonomous motivation, highlighting the relevance of competition among basic psychological needs.

An important contribution of this study is the direct relationship among competence and intention and com-

mitment, without the need for motivational regulations to mediate. These findings are highly relevant, since they suggest that encouraging adolescents to feel competent during the activities proposed in physical education can increase the chances that they will engage in extracurricular physical activity.

Focusing on the experiences developed in physical education, numerous studies have provided evidence on how certain strategies, characteristics of different pedagogical approaches (such as the creation of an environment that supports needs, the implementation of strategies that foster a task-oriented motivational climate, the use of inclusion styles or the sports education model) can improve the perception of competition.

These methodologies have some common features that could explain the positive effect on competition satisfaction. First, the provision of an optimal challenge [24,52,53] seems to be a valid tool to promote feelings of competence. Second, the clear establishment of norms and evaluation criteria could help students to be aware of their achievements and, therefore, to improve their competence satisfaction[52,53].

The role of integrated regulation in adherence to physical activity

In most of the studies that have addressed the study of autonomous motivation, the different regulations that make up this construct have not been considered. The present work represents an important contribution to the literature by studying separately the three regulations of autonomous motivation as previously suggested in the literature[54,55].

According to González-Cutre et al.[56], in integrated regulation, this not only implies identifying with the importance of behaviors, but also integrating these identifications in a harmonious and coherent way with other aspects of oneself (i.e., values, goals, personal needs and identity)[27,30].

In this case, for example, represents a person who practices physical exercise because it is part of their healthy lifestyle (i.e., they do not smoke, eat a balanced diet and attend regular check-ups with their GP).

Integrated regulation does not seem to occur in very young people, since at these ages the individual has not yet managed to integrate the different aspects that determine their lifestyle and personality[57].

The more integrated the behavior regulation, the more coherent it should be and the less the conflict with the regulation of other behaviors that are valued by the person (e.g., the practice of physical exercise does not have to interfere with other activities or obligations of the individual)[58].

In this study, it is interesting how integrated regulation is the one with the strongest association with the intention to be physically active. This leads us to think that the fact that students find physical activity aligned with other more general aspects of their lives (such as their personal values or priorities) may become more decisive for them to carry out physical activity than feeling intrinsically motivated to carry out physical activity. said activity.

This highlights the importance of physical education teachers facilitating individualized learning experiences that are meaningful to their students and that are aligned with their interests and values.

Limitations and future lines

This work has some limitations that should be noted. The first is linked to its descriptive and correlational nature, derived from the use of a standardized questionnaire with Likert scales based on self-response, which prevents access to the experiences and meanings linked to the study variables.

In this sense, future studies could adopt a qualitative or mixed approach that would help to achieve a more complete vision of the causal relationships between emerging variables. Also, it would be interesting to delve into the relationships between these variables by adopting quasi-experimental designs that allow us to verify the scope of the incorporation of teaching strategies aimed at favoring the satisfaction of basic psychological needs.

Second, the sample was made up of students from a single country, which may prevent us from generalizing the findings of this study.

Conclusions

The present work adds to the existing literature regarding the analysis of motivational variables and their relationship with the behavioral commitment shown in PE classes, as well as with the intention to be physically active.

In summary, the findings of this study suggest that the self-determination theory is an adequate framework to understand the behaviors of physical education students also in Brazil. The findings indicate, in line with previous works, that the satisfaction of the three psychological needs is significant in the experience of autonomous motivation, with competence satisfaction being especially relevant.

In addition, the predictive role that integrated regulation acquires on the intention to be physically active is highlighted.

Heading towards the conclusion, we must mention what an important mark this research is for the Brazilian and Latin-American studies about the triad Physical Education, Health and SDT.

At last, this research resulted in this avant-garde, in a most robust study with a significative number of subjects (almost 500 students), it also established dialogues with international literature, widening the possibilities of con-

struction of a more motivating, conscient and mobilizational P.E. for a better Health (inside and outside schools), for all lifelong.

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