



Research article

Contribution of perceived faculty caring (FC) and student engagement (SE) to lifelong learning (LLL) of post-secondary remediated (PSR) science students

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ARTICLE INFO

Keywords:

Faculty caring
Lifelong learning
Post-secondary education
Remediated science student
Student engagement

ABSTRACT

Literature is unequivocal about the relevance of promoting lifelong learning (LLL) intentions among adult learners. However, what is less certain in remedial education literature is how faculty members play a critical role in motivating the tendencies for LLL among remediated science students, especially in the developing countries. Therefore, this study investigated the contributions of faculty caring and student engagement to remediated science students' perceived LLL tendencies. Correlational research design was used to measure and gauge the level of the relationships amongst the studying variables. A total of 443 continuing education programme students in Nigeria participated in the study. By using AMOS v. 24 and SPSS v. 26 statistical tools for data analyses, we found a high level of student-perceived faculty caring, student engagement components and LLL tendencies. Multilevel regression analyses indicated that the dimensions of students' LLL tendencies (motivation and perseverance) were positively predicted by faculty caring and student engagement dimensions, such as vigour, absorption and dedication. In the final models, the predictor variables could explain some substantive proportions of motivation and perseverance dimensions of LLL tendencies. Our study findings reveal that faculty caring plays a significant role in motivating students' academic engagement and the tendencies for LLL in higher education. Therefore, educational intervention that gears towards improving student academic engagement has a practical implication in enhancing LLL tendencies amongst higher education science students. Hence, the study findings could inspire various educational practitioners to encourage effective academic engagement amongst higher education science students. Directions for further research were suggested.

1. Introduction

Remedial education program is a subject of relevance; therefore, several scholarly works have tried to explore its effectiveness in preparing the unprepared students for higher education attainment (Chen and Wu, 2020; Okwuduba et al., 2022; Sanabria et al., 2020). Of late, some researchers have suggested that remedial education program is effective way of reinforcing the unprepared students' basic skills in the area of reading, mathematics and science (Okwuduba et al., 2021; Zhao et al., 2021). Other scholars also noted that remedial education trajectories serve as gateway through which unprepared students get enrolled into various academic disciplines in the universities (Chen, 2016). However, heightened academic-related challenges such as lack of

motivation, persistent poor performance and learning dissatisfaction have been perceived to be inherent amongst higher education students, especially remediated students (Okwuduba et al., 2021; Sanabria et al., 2020). These academic-related issues have greatly contributed to the current decline in students' academic engagement and the tendency for LLL in higher education, particularly in the Nigerian context (Chukwuedo, 2019; Chukwuedo et al., 2021). Given that great emphasis has been placed on motivating LLL tendencies of adult learners (Chukwuedo et al., 2021; Garzón-Artacho et al., 2021), revitalising students' active engagement and sustaining their interest in learning are highly crucial for successful learning outcomes (Oppermann et al., 2021).

Notably, LLL concurs to behaviours that are characterised by individuals' ability to be actively involved in learning tasks and the desire

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Received 9 August 2021; Received in revised form 6 November 2021; Accepted 31 August 2022

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to acquire new knowledge, as well as the motivation to achieve an intended corresponding outcome (Chukwuodo, 2019; Tuparevska et al., 2020). The essence of LLL has been geared towards the equity, social cohesion and professional development of individuals in a society (Kolawole and Pusoetsile, 2021; Schuchart and Bühler-Niederberger, 2020). Research on LLL has become increasingly important due to its universal composition, environmental imperatives and prevalent access to global information in higher education (Bello, 2020; Milana et al., 2017; Salleh et al., 2019; Webb et al., 2019). In addition, LLL has gained wider recognition in educational fields perhaps because it covers formal and informal education, as well as other informal educational experiences of individuals (Chukwuodo, 2019; Chukwuodo et al., 2021).

By implication, various academic practitioners have advocated that fostering LLL tendencies, competencies and experiences amongst higher education students is essential (Chukwuodo, 2019; Chukwuodo et al., 2021; Oljira and Hailu, 2021; Salleh et al., 2019). Nevertheless, the paramount challenge is that higher education students' active participation in LLL activities has continued to dwindle globally (Roberts, 2018). Within the context of Nigeria, Chukwuodo et al. noted that the current economic meltdown and uncondusive social milieu contribute to the high rate of decline in students' engagement in LLL activities. The alienation rate appears to be more pronounced in unprepared students who take remedial education trajectories before enrolling into higher institutions (Chen, 2016; Turk, 2019). For instance, some authors recently estimated that more than 30% of American undergraduate students who successfully completed developmental courses could not earn their LLL certification even after spending six years in higher institutions (Sanabria et al., 2020). Other researchers have also purported that educational disadvantaged students seem to be perplexed with the huge university workloads and tend to express self-defeat behaviours, which affect their tendency for personal and professional development while in school and upon degree completion (Abdullah and Primus, 2020). Thus, LLL tendencies amongst remediated students should be promoted, and the sustainability of higher institutions should be improved.

Notably, the ability of higher education students to effectively engage in academic activities and attain optimal personal, as well as professional development, depends on motivating positive student to faculty relationship, also known as faculty caring (Snijders et al., 2020). This assertion is theoretically supported by Tinto's (1987, 1993) model of college departure, which proposes that students' motivation in LLL activities is assumed to rely on external supports in form of caring and interactions by faculty members. Previous research anchoring on this theoretical proposition has found faculty caring to be significant for students' academic success in higher education (Abdullah and Primus, 2020; Gopee and Deane, 2013; Ingraham et al., 2018; McEnroe-Petitte, 2011; Shelton, 2003; Snijders et al., 2020; Torregosa et al., 2016). A significant antecedent to faculty caring and tendency for LLL amongst higher education students is the extent of student engagement in academic activities (Chukwuodo et al., 2021; Kahu and Nelson, 2018; Tight, 2020). However, numerous studies have found that majority of students still experience low academic engagement in higher education (Caruth, 2018; Landis and Reschly, 2013; Pather et al., 2017; Xu et al., 2018), which might be due to the lack of institutional support in higher learning (Abdullah and Primus, 2020; Ingraham et al., 2018; Omogbadegun et al., 2014). Given that students' tendencies for learning can be motivated intrinsically and extrinsically (Jelas et al., 2016; Okwuduba et al., 2022), we deem it crucial to untangle the underlying contributions of faculty caring and student engagement to the tendency for LLL of remediated science students.

In line with the past related studies, we extend the present study by (1) focusing on faculty caring and student engagement as exogenous variables predicting LLL, (2) analysing these relations using a cross-sectional data and (3) focusing on undergraduate first-year students (UFYS) who are currently enrolled in continuing education programme (CEP) having completed science remedial courses in the Nigerian context. We consider the present study timely because the psycho-

emotional dispositions of UFYS who took remediation in the Nigerian context are associated with their science success (Okwuduba et al., 2021).

2. Literature review

In this section, previous studies were reviewed with the intent to gain a better understanding of the literature related to faculty caring, student engagement and LLL in higher education context. These studies were discussed in the subsequent subsections that follows.

2.1. LLL in higher education

In 1970, United Nations Educational, Scientific and Cultural Organisation (UNESCO) adopted LLL as a 'master concept' for quality education (Dave, 1976). However, LLL was popularized in September 2015, when the leaders of the United Nations adopted 'Quality Education' as one of the 17 goals of Sustainable Development Goal (SDG) (UNESCO, 2016). Quality education, which is emphasized in SDG number 4 in the UNESCO seminal document, is defined as inclusiveness and equitable education as well as promotion of LLL opportunities for all individuals (UNESCO, 2016). In essence, rather than advocating for learning and education that will be limited to elementary, adolescence and/or early adulthood, learning should be presented as a process in which every individual is involved throughout life (Webb et al., 2019). A perspective, if taken seriously, is central to the realization of other development goals [e.g. Goal 3 (Health and Well-Being), Goal 5 (Gender Equality), Goal 8 (Decent Work and Economic Growth) and Goal 13 (Climate Change Mitigation)] by 2030 (Webb et al., 2017).

In higher education literature, the concept of LLL has been interpreted differently based on the context the term has been applied. For instance, different authors have conceptualised LLL as continuing higher education, second-chance education, postgraduate education or adult learning (Morgan-Klein and Osborne, 2007; Nwosu et al., 2018; Salleh et al., 2019; Schuchart and Bühler-Niederberger, 2020). Basically, LLL is defined as a learning strategy that connects the indices of learning skills, critical thinking, systematic planning and practices through self-autonomously generated and development of reflexivity (Boeren et al., 2010; Salleh et al., 2019). Policies regulating LLL usually focus on the need for civic participation and active learning, as well as acquisition of skills and competencies for easy adjustment in a changing and unpredictable world (Tuparevska et al., 2020). Notably, LLL practically covers all aspects of education probably because it encompasses formal and informal education, as well as informal adult learning experiences (Chukwuodo, 2019; Chukwuodo et al., 2021). The essence of LLL implementation across the globe is to promote lifelong learners' acquisition of new knowledge, skills, attitude and competencies for occupational and personal needs, as well as to adapt to changing and uncertain world conditions (Ozdamli and Ozdal, 2015).

Empirical evidence has revealed that LLL is related to other personality constructs in higher education (Chukwuodo, 2019; Chukwuodo et al., 2021; Salleh et al., 2019). For instance, various researchers have linked positive association of LLL to student active engagement (Chukwuodo et al., 2021), student career satisfaction and willingness to upgrade in life (Chukwuodo, 2019), as well as self-directed and autonomous learning (Chukwuodo et al., 2021; Salleh et al., 2019). Moreover, lifelong learners possess adaptive attributes, such as curiosity, perseverance, motivation and self-regulatory behaviours (Coşkun and Demirel, 2010), which are relevant in personal growth and professional development in the real world (Mbagwu et al., 2020).

Although LLL has been explicitly researched in the previous higher education studies, the tendency for LLL amongst remediated students has not been specifically considered in the past. Remediated students are regarded to be struggling students and underprepared academically (Chen, 2016); thus, they are more susceptible to exhibit some level of decline in participating in learning activities compared with those who

do not require remediation (Sanabria et al., 2020). Hence, the tendency for LLL in higher educational institutions cannot be easily generalised amongst remediated students because they have their peculiar characteristics (e.g. having taken remedial processes) different from educationally advantaged ones. Therefore, LLL tendency, specifically for students who took remedial education in higher education, should be further explored. According to the perspective adopted in this study, LLL tendency dovetails to behaviours that are geared towards motivating remediated students' predisposition to regularly undertake formal and informal, as well as non-formal learning experiences for personal and professional development until degree completion.

2.2. Student engagement in higher education

The relevance and significant role of student engagement in higher education has been extensively researched recently (Chukwuodo et al., 2021; Fredricks et al., 2016; Kahu and Nelson, 2018; Snijders et al., 2020). Nevertheless, diverse theoretical meaning and conceptualisation of student engagement have emerged in academic literature, in which different instruments have been developed to measure the construct (Kahu, 2013; Kahu and Nelson, 2018). For instance, some researchers have conceptualised student engagement as a multidimensional construct that is characterised by interrelated behavioural (e.g. active participation and task completion), emotional (e.g. positive feelings and enjoyment) and cognitive (e.g. deep-learning and self-regulation) components (Finn and Zimmer, 2012; Fredricks et al., 2004). However, in line with higher education literature, student engagement is one's positive state of mind dovetails to personality behaviours, including vigour, dedication and absorption (Bakker et al., 2015; Chukwuodo et al., 2021; Schaufeli et al., 2006; Snijders et al., 2020). Interestingly, other researchers have noted that the indicators of behavioural, cognitive and emotional engagement are integrated well in the subdimensions of vigour, dedication and absorption (Fredricks et al., 2016).

Vigour is attributed as the willingness of students to devote more efforts in learning activities (Snijder et al., 2020). It is also typified as mental resilience and high level of energy exhibited by students in academic activities, as well as persistence in tackling difficult academic-related situations (Chukwuodo et al., 2021). Dedication is characterised by students' strong involvement in learning activities while experiencing a sense of pride, inspiration, enthusiasm and importance (Bakker et al., 2015). Finally, absorption refers to the state of mind at which one is totally concentrated and fully engrossed in learning activities, such that one finds separating oneself from studying difficult (Snijder et al., 2020). These components of student engagement concur with students being active participants in academic activities (Schaufeli et al., 2006). Hence, we deem that their unique contributions to LLL tendency of remediated students, which appear to be meagre in the literature, should be explored. Thus, we conceptualise student engagement in this study context as extent to which students are encouraged to commit their time and energy in education-related activities to enhance their academic outcomes.

2.3. Faculty caring for and interactions with students in higher education

In higher education, faculty members are recognised as the key socialising agents whose positive interactions with and caring for students' needs have helped improve and sustain students' persistence and retention until college graduation (Kim and Lundberg, 2016; Pascarella and Terenzini, 2005). Indeed, studies stemming from higher education literature have revealed that faculty caring for and interactions with students are positively associated with a wide range of school-based outcomes, such as high academic grade point average (Al-Hussami et al., 2011; Torregosa et al., 2016), high retention rate of students (McEnroe-Petitte, 2011; Shelton, 2003), strong academic desire and

cognitive still development (Kim, 2010; Kim and Lundberg, 2016), as well as enhanced students' self-concept and motivation (Kim and Sax, 2014).

In addition, studies focusing on student–faculty relationships have also received higher recognition recently due to the current developmental measures being adopted in higher education. Some of the developmental measures include the use of students' degree completion rate as a proxy for university quality assurance or performance-based funding (Dougherty and Natow, 2019; Favero and Rutherford, 2020; Ortagus et al., 2020), universal competition amongst world-leading higher institutions, attraction of international students and university rankings (Elken et al., 2016; Piro and Sivertsen, 2016). All these have contributed to the direction of developing a positive and strong interpersonal relationship amongst various education stakeholders in higher education to the fore. Moreover, given that positive student–faculty relationships can enhance students' academic engagement, as well as their sense of belonging (Snijders et al., 2020; Wong et al., 2019), and, in turn, mitigate the rate of students' attrition and alienation from school (Njoroge et al., 2016), they deserve researchers' attention on their contributing influences on students' tendencies for LLL in higher education.

2.4. Faculty caring, student engagement and LLL in higher education

Researchers are increasingly showing interest in research related to LLL in higher education, possibly due to the documented effects on prosocial and motivational behaviours (Chukwuodo, 2019; Chukwuodo et al., 2021; Coşkun and Demirel, 2010; Mbagwu et al., 2020; Ozdamli and Ozdal, 2015; Salleh et al., 2019). In essence, nurturing LLL in higher education has become critical, given the ever-evolving global developmental trajectories. Instead of advocating for learning and education that are limited to elementary, adolescence and early adulthood, practitioners in education have emphasized the necessity to foster LLL tendencies amongst higher education students (Chukwuodo, 2019; Chukwuodo et al., 2021; Salleh et al., 2019). In as much as literature is unequivocal about the relevance of LLL in students' future career, the factors that can foster and consistently maintain it can be considerably more important. Previously, Jelas et al. (2016) have noted that students' tendencies for learning can be inspired by intrinsic and extrinsic antecedents. Intrinsically, student engagement have been found to affect learning in school (Abdullah and Primus, 2020; Ingraham et al., 2018; Omogbadegun et al., 2014), and it can be enhanced by external factors, including faculty caring (Snijders et al., 2020). Therefore, motivating student academic engagement through faculty caring can promote the tendencies for LLL.

Nevertheless, limited research evidence has examined the relationships amongst faculty caring, student engagement and LLL. For instance, prior studies have shown that positive student–faculty relationships can contribute to academic engagement of Netherland higher education students (Snijders et al., 2020), but the tendencies for LLL were not considered in the research. Likewise, a certain research study has revealed that academic engagement dimensions serve as contributing factors to LLL tendencies of Nigerian adult education learners (Chukwuodo et al., 2021), but modalities by which faculty members externally motivate LLL tendencies were not corroborated in the research. Mbagwu et al. (2020) indicated that LLL should not be static but dynamic, especially in addressing difficult tasks like intention for skill upgrading in life, and that it should not be restricted to only internally imposed direction of learning. Because remediated students, who were once unprepared academically, still need additional learning supports for science success in universities (Zhao et al., 2021), the presence of faculty caring as a contributing factor is considered appropriate in promoting LLL intentions. Based on these identified gaps, we intend to extend literature and advance knowledge in the understanding of the contributions of faculty caring and student engagement to LLL of remediated science students in Nigerian context.

2.4.1. Rationale for the present study

This study aims to offer a new insight into the relationship amongst faculty caring, student engagement (vigour, absorption and dedication) and the remediated students' tendencies (motivation and perseverance) for LLL. Hence, the current study considers a correlative function of exogenous variables in predicting LLL tendencies. The assumptions are that high faculty caring and student engagement dimensions will significantly contribute to the tendency for LLL. To examine this assumption, we adopted a faculty concerns measure used in a core module in the University of California Undergraduate Experience Survey (UCUES), which was previously adapted and validated in past research and found to be adequate for students with pre-collegiate experience in higher education (Kim and Lundberg, 2016). We adopted faculty caring measure because our study specifically considered the caring and concerns provided by faculty members to students with pre-university education experience (remediated students). These students are educationally disadvantaged and academically unprepared (Chen, 2016). Thus, we believed that adequate understanding of faculty caring and its relationship with other psychosocial constructs will shed more light on how to support our students' learning.

We conducted two regression analyses by considering two LLL tendencies, namely, motivation and perseverance, as the criterion variables. On the basis of the literature review, student-perceived faculty caring may influence student engagement (Snijders et al., 2020; Torregosa et al., 2016). Thus, we considered perceived faculty caring as the first predictor of LLL. Afterwards, we entered student engagement dimensions in a stepwise manner to enable us explore the distinct predictive nature of engagement dimensions, including vigour, dedication and absorption, in the model. The essence of conducting the regression analysis is to justify if our studying variables will explain a significant amount of variance in LLL tendencies, while controlling for other variables. This study is one of the first attempts to specifically consider remediated students' perception on how faculty caring contributes to their tendency for LLL. We believed that the more remediated students are engaged and supported in their studies, the less likely they will drop out from school, which is the essence of remediation.

On the basis of the rationale for this study, we formulated the following research questions to guide the study:

1. Does faculty caring predict LLL tendencies (motivation and perseverance) amongst remediated science students?
2. Does vigour predict LLL tendencies (motivation and perseverance) amongst remediated science students after controlling for faculty caring?
3. Does dedication predict LLL tendencies (motivation and perseverance) amongst remediated science students after controlling for faculty caring and vigour?
4. Does absorption predict LLL tendencies (motivation and perseverance) amongst remediated science students after controlling for faculty caring, vigour and dedication?

3. Methods

In this section, the step-by-step process taken to conduct the study, analysis of results and discussion of major findings were explained, followed by the conclusion and recommendations for further studies.

3.1. Research procedure

The present study utilised a correlational research design to examine and gauge the interconnections amongst student-perceived faculty caring, student engagement and their LLL tendencies in higher education. Given the established bivariate correlations, we explored the predictive dimensions of faculty caring and student engagement on dimensions of students' LLL tendencies via multilevel regression analyses (Tas, 2016). The dimensions of student engagement that we considered in the

regression analyses include vigour, dedication and adsorption, whereas LLL was treated as endogenous variable from the lens of students' motivation and perseverance. Faculty caring was treated as a one-dimensional construct. As noted in various studies, we used R-square to identify the specific contributions of the exogenous variables on the endogenous variable, as well as determine the incremental validity of the various dimensions of the predictive variables under investigation (Okwuduba et al., 2021; Tas, 2016; Thomas et al., 2017).

3.2. Research participants

The population of the study was UFYS in a southeast public university in Nigeria who recently completed remedial science gateway courses in the 2018–2019 academic session. The population was considered because the students were currently enrolled in a LLL programme known as CEP. Several steps were taken before the collection of data from the said population. Firstly, approval of the current study was sorted and obtained from the Institution Research Board (UM.P/PTD (IT)/6441/1). Secondly, we followed the ethical standard stipulated for data collection in behavioural sciences. For instance, written informed consents of the participants were taken before they participated in the study. We also explained to the consented participants about the purpose of the study in detail before the study commenced. The consent agreement form and information sheet describing the research purpose were attached together with the questionnaire. In addition, the participants were informed that they were free to opt out from the study at any time they feel so. Lastly, we equally assured the participants that their personal identities would not be made known to the public, and their responses would be kept in a reputable repository for easy accessibility and reuse.

In the end, a sample of 443 UFYS (62.8% female and 37.2% male) with mean age of 19.02 and standard deviation of 1.7 were considered in the present study. The said sample was randomly selected using multi-stage sampling method. Firstly, we purposefully selected one school for the study because we considered only the Nigerian university operating CEP. Secondly, we used cluster sampling method because we randomly selected groups (classes) instead of students (Fraenkel and Wallen, 2009). For instance, three intact classes were randomly selected from the participating school and all the students in the selected intact classes form the total sample size. With the help of participants' course lecturers, the distribution of the questionnaires and retrieval were conducted within 30 min period by adopting paper-and-pencil method.

3.3. Survey instruments

3.3.1. Faculty caring questionnaire

Faculty caring questionnaire was adopted from a core module in the UCUES known as 'faculty concerns' (Kim and Lundberg, 2016). This construct consists of four items on a 5-point scale, ranging from 1 'strongly disagree' to 5 'strongly agree'. We considered the instrument adequate in the present study because it was constructed to gather information on perceived-faculty concerns and caring from undergraduate students with pre-collegiate experience. The internal consistency of the instrument was previously reported as 0.88 for American students (Kim and Lundberg, 2016).

3.3.2. Student engagement questionnaire

A short Utrecht Working Engagement Scale (UWES-9) was adopted and used to measure student engagement in the study (Schaufeli et al., 2006). The instrument has three dimensions, namely, vigour, dedication and absorption. The construct was assessed with nine items on a 5-point scale, from 1 'strongly disagree' to 5 'strongly agree'. Previous studies have adopted the scale to measure student academic engagement in higher education (Chukwuedo et al., 2021; Salmela-Aro and Read, 2017; Snijders et al., 2020). The alpha value of the subconstructs ranges from 0.83 to 0.91 when used for Netherland college sample, as well as

Nigerian university students (Chukwuedo et al., 2021; Snijders et al., 2020).

3.3.3. LLL questionnaire

We adopted and used an LLL tendency scale developed by Coşkun and Demirel (2010) for the study. The instrument consists of four subconstructs, namely, motivation, perseverance, self-regulation and curiosity. However, we delimited it to only motivation and perseverance, which contain six items each because the two dimensions are characterised by grit, which has been linked to underprepared students' retention in higher education (Fosnacht and Webb-Copridge, 2021). The construct was scaled in a 5-point Likert-type scale, from 1 'strongly disagree' to 5 'strongly agree'. Previous researchers who have adopted the measure in assessing Nigerian students' LLL in adult education have reported high internal consistency ($\alpha = 0.87\text{--}0.90$) for the scale (Chukwuedo et al., 2021).

3.4. Tools for the procedure, measurements and analysis of data

We analysed the data using SPSS v. 26 and AMOS v. 24.0. We used SPSS to perform descriptive statistical analyses and hierarchical regression analyses, and we used AMOS to establish the measurement models of the constructs. For assumption checks, we initially screened the data for outliers in each subconstructs using boxplot (Schwertman et al., 2004). Secondly, we tested for normality of the data using kurtosis and skewness scores of individual items at 0.05 significant level by considering a range of -1.96 to $+1.96$ (Hair et al., 2010). In addition, we checked for multivariate normality by focusing on homoscedasticity problems. Finally, we examined multicollinearity issues with tolerance and variance inflation factor (VIF; Pallant, 2020).

We established the measurement model of the research instrument by performing confirmatory factor analysis (CFA) using AMOS 24 (Byrne, 2013). In the process, we considered several compatible fit tests, such as chi square (χ^2), root mean square error of approximation (RMSEA), goodness of fit index (GFI), Tucker–Lewis index (TLI) and comparative fit index (CFI; Awang, 2012; Hu and Bentler, 1999). In line with the previous literature, we performed these measurement models to cover the three recommended categories of model fit tests, namely, parsimonious fit (e.g. chi square/degree of freedom), incremental fit index (e.g. TLI and CFI) and absolute fit index (RMSEA, GFI and chi square test; Copriady et al., 2021). Acceptable cut-off statistics as recommended include the following: probability value should be less than 0.05; TLI, GFI and CFI values should be greater than 0.90; and RMSEA should be less than 0.08 (Awang, 2012; Hu and Bentler, 1999).

In addition, we determined the internal consistency of the instruments using Cronbach's alpha (α) and composite reliability (CR; Hair et al., 2010); the discriminant validity was determined using average variance extraction (AVE) (Fornell and Larcker, 1981), as well as by examining the correlation matrices (Kline, 2005). An alpha value of 0.7 and above is satisfactory for CFA (Hair et al., 2010), whereas a CR value of 0.6 and AVE of 0.5 and above are acceptable (Hair et al., 2010). In addition, a correlation matrix less than 0.90 suggests that the discriminant validity of the construct is acceptable (Kline, 2005).

4. Data analysis and interpretation

4.1. Preliminary analysis: assumption check, validity and reliability

The preliminary data analysis revealed that the current study presented data with no missing values. For the normality check, the skewness and kurtosis values ranged from -0.037 to 0.806 , which fall within -1.96 to $+1.96$ acceptable range (see Table 2), indicating that the data were normally distributed (Hair et al., 2010). Furthermore, our examination of residual values revealed that issue of homoscedasticity was non-existent, indicating that multivariate normality assumption was met (Jamshidian and Jalal, 2010). In addition, our evaluation of VIF and

tolerance T revealed that no multicollinearity issues existed because from the preliminary results, VIF ranged from 1.624 to 3.716, which is less than 5.0, and the tolerance ranged from 0.269 to 0.616, which is greater than 0.20 (Pallant, 2020).

We further examined the construct by assessing the internal consistency using α and CR. The α values ranged from 0.705 to 0.902, and the CR values ranged from 0.701 to 0.919, exceeding the 0.70 required cut-off (Hair et al., 2010). Thus, the construct reliability was acceptable for all the latent variables, such as dimensions of student engagement (vigour, dedication and absorption), dimensions of LLL (motivation and perseverance) and faculty caring. Subsequently, we assessed the discriminant validity of the constructs using AVE. Although the values of AVE for some latent constructs were below .50 required standard, Fornell and Larcker (1981) were of note that AVE value less than .5 is acceptable provided that the CR value of the latent variable is .60 and above. Table 1 presents the item descriptions, factor loadings, internal consistencies and validity of the unobservable variables.

4.2. Preliminary bivariate correlations amongst the constructs

The current study presented a high significant correlation amongst faculty caring and dimensions of student engagement and LLL (Table 2). For instance, faculty caring was significantly correlated with various dimensions of LLL, such as motivation ($r = 0.502$) and perseverance ($r = 0.590$), as well as dimensions of student engagement [e.g. vigour ($r = 0.816$), dedication ($r = 0.572$) and absorption ($r = 0.752$)]. Although the bivariate correlation between faculty caring and vigour is high, it is still below .90 recommended cut off (Kline, 2005), indicating no multicollinearity issue. Besides, the VIF and T values are also within the acceptable range. Furthermore, various dimensions of student engagement were also significantly correlated with aspects of LLL. Firstly, vigour was related to motivation ($r = 0.536$) and perseverance ($r = 0.615$). Secondly, dedication was related to motivation ($r = 0.560$) and perseverance ($r = 0.717$). Lastly, absorption was correlated with motivation ($r = 0.544$) and perseverance ($r = 0.751$). In addition, the bivariate correlations were below 0.90 maximum value, thereby affirming the discriminant validity of the constructs (Kline, 2005). Moreover, a variation was observed in the mean scores amongst the latent variables, as shown in Table 2.

4.3. Measurement models

For the measurement model, we used CFA to validate the factor structure of the three latent constructs before performing multilevel hierarchical regression analysis. The results from CFA revealed that the measurement model of faculty caring provided an acceptable model fit, with fit statistics of $\chi^2 = 0.793$, $\chi^2/df = 0.396$, CFI = 1.00, GFI = 0.999, TLI = 1.00 and RMSEA = 0.000. Furthermore, the measurement model of student engagement presented an acceptable model fit, with fit statistics of $\chi^2 = 70.737$, $\chi^2/df = 3.368$, CFI = 0.974, GFI = 0.966, TLI = 0.955 and RMSEA = 0.073. In addition, the measurement model of LLL indicated a good fit, with various fit indices of $\chi^2 = 157.395$, $\chi^2/df = 3.579$, CFI = 0.950, GFI = 0.947, TLI = 0.924 and RMSEA = 0.076. Moreover, the standard factor loadings for all the latent variables exceeded the already accepted 0.30 cut-off for regression analysis by previous researchers (see Table 1; Chan, 2008; Erdim and Zengin, 2020). The results of the confirmatory factor analyses are shown in Table 3.

4.4. Regression analysis

We examined the predictive effects of perceived faculty caring and student engagement variables on LLL by conducting multilevel regression analyses. In the first model, the motivation subdimension of LLL tendencies was initially predicted, as shown in Table 4. Faculty caring was added in the first step as a potential exogenous variable predicting motivation. The result showed that faculty caring significantly predicted

Table 1. Factor loadings and internal consistencies for CFA (n = 400).

S/N	Factors/Item descriptions	Factor loadings	CA	CR	AVE
	(a) Student engagement dimensions i. Vigour		0.828	0.852	0.658
1	I am always so energetic whenever I am studying.	0.800			
2	I feel like going to school every morning I get up.	0.826			
3	In school, I am so resilient, and I devote my effort to learn.	0.807			
	ii. Dedication		0.705	0.713	0.429
4	I am proud of studying new things.	0.705			
5	I am inspired by my studying.	0.635			
6	I perceive studying to be purposeful and meaningful.	0.621			
	iii. Absorption		0.776	0.779	0.550
7	When I am reading my book, time flies so quickly.	0.542			
8	Nothing around me matters when I am reading.	0.781			
9	I am fully engrossed with my studies.	0.864			
	(b) LLL dimensions i. Motivation		0.772	0.765	0.355
1	I am more willing compared with my classmates in learning new knowledge and skills.	0.531			
2	I am passionate to learn innovative things at all time.	0.562			
3	I am curious to acquire new knowledge and skills always.	0.621			
4	One of my underlying aims is to improve on my personal development.	0.670			
5	I easily learn new ideas that can enhance my personal development.	0.661			
6	I continually gain new knowledge and skills even though I am financially capable.	0.513			
	ii. Perseverance		0.816	0.800	0.412
7	I devote most of my time studying and learning.	0.441			
8	I make time to learn new information even with my busy schedule.	0.471			
9	I personally budget my time for learning new knowledge and skill.	0.706			
10	I put in more efforts in gaining new knowledge and skill.	0.745			
11	I learn new ideas that are not related to my priority.	0.666			
12	I try to learn even if the course is very difficult and challenging.	0.749			
	(c) Faculty caring		0.902	0.919	0.748
1	Faculty members discuss my course materials with me even outside the class.	0.876			
2	I have a good communication with faculty members through email, social media and in person.	0.990			
3	My interactions with faculty members are lively during lecture class sessions.	0.552			
4	I always work with faculty members on activity outside coursework.	0.969			

Note: (a) was adapted from [Snijders et al. \(2020\)](#); (b) was adapted from [Chukwuedo et al. \(2021\)](#); and (c) was adapted from [Kim and Lundberg \(2016\)](#). CA = Cronbach's alpha; CR = composite reliability; and AVE = average variance extraction. All the items had loadings of 0.441 and above.

students' motivation in higher education ($\beta = 0.502$, $t = 12.205$, $p < 0.01$). In the second step, we added vigour to the model, and the result revealed that the criterion variable was significantly predicted by the exogenous variable ($\beta = 0.376$, $t = 5.448$, $p < 0.01$). In addition, vigour was able to explain an additional 4.7% of the variance in the criterion variable. In the third step, we included dedication in the regression model, which explained an additional 7.0% of the variance in the students' motivation. Thus, students who demonstrated a high level of dedication also reported a high level of motivation in higher education ($\beta = 0.357$, $t = 6.967$, $p < 0.01$). In the final step, we added absorption in the model, and the exogenous variable significantly predicted the endogenous variable ($\beta = 0.204$, $t = 3.263$, $p < 0.01$), accounting for additional 1.5% variance in the students' motivation. Furthermore, the R^2 in each stage of the analysis was statistically significant, indicating model improvement as we proceeded with the hierarchical multiple regression analysis. At the end, 37.9% of variance in the students' motivation was accounted for in the final model.

In the second model, the perseverance subdimension of LLL tendencies was the criterion variable, as shown in [Table 5](#). Faculty caring was added in the first step as a potential exogenous variable predicting perseverance. The outcome of the analysis revealed that faculty caring significantly predicted students' perseverance in higher education ($\beta = 0.590$, $t = 15.354$, $p < 0.01$). In the second step, we added vigour to the model, and the result revealed that the criterion variable was significantly predicted by the exogenous variable ($\beta = 0.398$, $t = 6.237$, $p < 0.01$). In addition, vigour was able to explain an additional 5.3% of the

variance in the criterion variable. In the third step, we included dedication in the regression model, which explained an extra 16.2% of the variance in the students' perseverance. Thus, students who demonstrated a high level of dedication also reported a high level of perseverance in higher education ($\beta = 0.545$, $t = 12.775$, $p < 0.01$). In the final step, we added absorption in the model, and the exogenous variable significantly predicted the endogenous variable ($\beta = 0.501$, $t = 10.664$, $p < 0.01$), accounting for additional 9.0% variance in the students' perseverance. Furthermore, the R^2 in each stage of the analysis was statistically significant, indicating a model improvement as we proceeded with the regression analysis. At the end, 65.4% of variance in the students' perseverance was accounted for in the final model.

5. Discussion of the findings

Students' perceived faculty caring deserves considerable attention in higher education because students are regarded as one of the substantial stakeholders in tertiary institutions ([Snijders et al., 2020](#)). A better understanding of faculty caring and its relationships with other students' personality constructs is crucial in enhancing how to support students' learning. Students' perspectives in the tertiary learning should be considered when examining what aspects of faculty caring are crucial for developing and improving positive relationships with them ([Torregosa et al., 2016](#)). Establishing positive student to faculty relationships and interactions may likely motivate student engagement and improve their tendency for LLL educational activities in school and upon graduation.

Table 2. Bivariate correlations amongst all the latent variables.

S/N	Variable	1	2	3	4	5	6
1	Faculty caring	1	0.572**	0.752**	0.502**	0.590**	0.816**
2	Dedication		1	0.656**	0.560**	0.717**	0.672**
3	Absorption			1	0.544**	0.751**	0.689**
4	Motivation				1	0.643**	0.536**
5	Perseverance					1	0.615**
6	Vigour						1
	Skewness	-0.806	-0.478	-0.443	-0.485	-0.227	-0.612
	Kurtosis	-0.037	-0.406	-0.646	-0.278	-0.403	-0.311
	<i>M</i>	3.73	3.55	3.36	3.58	3.21	3.61
	<i>SD</i>	1.10	1.00	1.11	0.919	0.982	1.07

Note: ** $p < 0.01$ (two-tailed), *M* = mean and *SD* = standard deviation.

Table 3. Measurement model of the variables under study.

Variables	χ^2	χ^2/df	<i>TLI</i>	<i>CFI</i>	<i>GFI</i>	<i>RMSEA</i>
Faculty caring	0.793	0.396	1.000	1.000	0.999	0.000
Student engagement	70.737**	3.368	0.955	0.974	0.966	0.073
LLL	157.395**	3.579	0.924	0.950	0.947	0.076
Acceptable standard	$p > 0.005$	$\chi^2/df < 5.00$	> 0.900	> 0.900	0.900	< 0.080

Note: ** $p < 0.01$; χ^2 = chi square, *df* = degree of freedom, *TLI* = Tucker Lewis Index, *CFI* = Comparative Fit Index, *GFI* = Goodness of Fit Index, *RMSEA* = root mean square error of approximation.

Therefore, the present study examined the LLL tendencies of UFYS who transitioned into higher institution having successfully completed their remedial science courses in relation to perceived faculty caring. Student engagement variables were also investigated. We conducted two hierarchical multiple regression analyses with the dependent variables of dimensions of students' LLL tendencies, including motivation and perseverance. Student engagement was separated into vigour, dedication and absorption in the regression model for possible identification of the distinct predictive nature of each subdimensions. Overall, the findings revealed significant correlations amongst the latent variables under study.

The preliminary results revealed that faculty caring was significantly related to the dimensions of students' LLL tendencies, such as motivation and perseverance. Moreover, student engagement dimensions, such as vigour, absorption and dedication, were significantly associated with the

dimensions of LLL tendencies. The relative contributions of the distinct exogenous variables on various dimensions of students' LLL were further examined. Our analyses revealed that faculty caring explained a statistically significant amount of variance in the dimensions of LLL tendencies. In other words, positive student-faculty relationships in form of faculty caring contributed to improving students' motivation and perseverance in higher education. This finding was anticipated because prior empirical studies have reported that students' perceptions of faculty members showing caring, support and mentorship in higher education were significantly related to several adaptive school-based outcomes, such as high cognitive skill development (Kim and Lundberg, 2016), higher students' retention rate (McEnroe-Petitte, 2011; Shelton, 2003), higher student loyalty (Snijders et al., 2020), high resilient spirit (Crombie et al., 2013; McDonald et al., 2013) and positive feelings of sense of belonging in future orientation (Wong et al., 2019). Our results

Table 4. Multilevel regression analysis predicting the motivation aspect of LLL.

Steps	Variables	Unstandardised Coefficients		Standardised Coefficients
		<i>B</i>	Std. Error	Beta
1	(Constant) $R^2 = 0.252^{**}$	10.406	0.665	
	Faculty caring	0.522	0.043	0.502**
2	(Constant) $\Delta R^2 = 0.047^{**}$	9.359	0.673	
	Faculty caring	0.204	0.072	0.196*
	Vigour	0.535	0.098	0.376**
3	(Constant) $\Delta R^2 = 0.070^{**}$	7.327	0.702	
	Faculty caring	0.177	0.068	0.171*
	Vigour	0.223	0.103	0.156*
	Dedication	0.545	0.078	0.357**
4	(Constant) $\Delta R^2 = 0.015^{**}$	7.373	0.695	
	Faculty caring	0.062	0.076	0.060
	Vigour	0.216	0.102	0.152*
	Dedication	0.442	0.083	0.290**
	Absorption	0.282	0.086	0.204**

Note: Dependent variable = motivation; ** $p < 0.01$; * $p < 0.05$.

Table 5. Multilevel regression analysis predicting the perseverance aspect of LLL.

Steps	Variables	Unstandardised Coefficients		Standardised Coefficients
		B	Std. Error	Beta
1	(Constant) $R^2 = 0.348^{**}$	7.528	0.797	
	Faculty caring	0.787	0.051	0.590 ^{**}
2	(Constant) $\Delta R^2 = 0.053^{**}$	6.106	0.798	
	Faculty caring	0.355	0.085	0.266 ^{**}
	Vigour	0.727	0.117	0.398 ^{**}
3	(Constant) $\Delta R^2 = 0.162^{**}$	2.126	0.750	
	Faculty caring	0.303	0.073	0.227 ^{**}
	Vigour	0.116	0.111	0.063
	Dedication	1.066	0.083	0.545 ^{**}
4	(Constant) $\Delta R^2 = 0.090^{**}$	2.270	0.669	
	Faculty caring	-0.061	0.073	-0.045
	Vigour	0.094	0.099	0.051
	Dedication	0.743	0.080	0.380 ^{**}
	Absorption	0.888	0.083	0.501 ^{**}

Note: Dependent variable = perseverance; ^{**} $p < 0.01$; ^{*} $p < 0.05$.

are also consistent with the findings of previous researchers (Dwyer, 2017; Ingraham et al., 2018; Trolan et al., 2016), possibly because students' relationships with faculty staff when perceived positively can lead to positive student outcomes, such as high academic motivation and high rate of persistence, which, in turn, mitigate students' alienation rate in higher education (Torregosa et al., 2016).

In addition to faculty caring, the present study examined the distinct predictive nature of student engagement dimensions, including vigour, dedication and absorption, on LLL tendencies, such as motivation and perseverance. Our findings revealed that vigour positively predicted various dimensions of LLL, accounting for additional 7% and 5.3% variance of students' motivation and perseverance in the separate models, respectively. Thus, highly energetic students who are more resilient and willing to devote their time to study are highly motivated and persevere in the face of difficult tasks. These results are in line with the findings of previous studies, which revealed that vigour is positively related to dimensions of students' LLL tendencies, including motivation and perseverance (Chukwuedo et al., 2021). Moreover, students tend to be more satisfied in LLL career when they demonstrate high level of willingness factor in skill upgrading (Chukwuedo, 2019). In addition, students can easily develop a loyal attitude in school, such as willingness to learn and positive interpersonal relations with faculty staff, when they are more vigorous at their studies (Snijders et al., 2020).

Dedication was examined as another student engagement subconstruct acting as a predictor of students' LLL tendencies. We found that student dedication predicted their LLL. Similar findings have been reported by the previous researchers. For instance, Chukwuedo et al. (2021) found that students' perceptions that they are highly dedicated and enthusiastic to study adult education courses positively predicted motivation and perseverance (dimensions of students' LLL tendencies). Similarly, dedication was found to be strongly connected with students' affective components in higher education, such as students' loyalty and trust in honesty (Snijders et al., 2020). In relating how students' dedication affect LLL, Chukwuedo et al. (2021) stated that students' dedication to their studies can be facilitated through self-directed learning intervention, which enhances students' self-regulation, curiosity, perseverance and motivation for individual knowledge and professional development in their area of specialisation. This finding is interesting for higher education stakeholders who want to improve on the level of student dedication in their studies, especially now that more emphasis has been placed on the significant role of self-directed learning in enhancing student-centred mode of lesson delivery (Smith, 2016).

Absorption was examined as the final student engagement variable acting as a predictor of LLL. The results from our analyses revealed that

student absorption in their studies accounted for significant variance in the dimensions of student LLL tendencies, including motivation and perseverance. Hence, when students are fully concentrated and happily engrossed in their studies, they tend to be motivated to learn, as well as persevere amidst academic challenges. Our results are consistent with the finding of similar studies in higher education literature (Buil et al., 2019; Chukwuedo et al., 2021; Snijders et al., 2020), possibly because students' absorption promotes their adaptive outcome. These student adaptive outcomes include high loyalty behaviour of students (Snijders et al., 2020), self-directed learning strategies (Chukwuedo et al., 2021) and enhanced students' flow, high sense of control and heightened concentration (Buil et al., 2019) in academic activities.

Furthermore, the results from the final models revealed that the predictive nature of faculty caring on LLL tendencies was no longer significant when all the dimensions of student engagement were entered. This finding illustrates the fact that student engagement can be an overwhelming factor that strongly moderates the influence of perceived faculty caring on students' retention in higher education (Kahu and Nelson, 2018; Tight, 2020). The finding can also explain the claims that student engagement is the foundation for students' academic success in higher education, which is highly reflected in individual self-regulatory practices (Chukwuedo et al., 2021) and students' autonomy, as well as self-direction in LLL (Salleh et al., 2019).

6. Conclusions, limitations and recommendations for future research

In conclusion, our study has revealed that perceived faculty caring and student engagement dimensions such as vigour, absorption and dedication made significant contributions to students' LLL tendencies including perseverance and motivation. The results of the current study provided further evidence that a total of 65.4% of variance in the students' perseverance and 37.9% of variance in the students' motivation were accounted for in the final models by the predictor variables. The results of the present study were related to the findings of previous studies (Buil et al., 2019; Chukwuedo et al., 2021; Snijders et al., 2020), possibly because faculty caring and student engagement are valuable pathways for motivating students' tendencies for LLL in higher education.

Although the present study has made significant contributions to knowledge, it has several limitations. Our study is not a longitudinal study and was limited to only one school, which limits the generalisability of our findings. Our study also addressed only two dimensions of LLL tendencies excluding self-regulatory and curiosity. Moreover, the

associations of faculty caring, student engagement and LLL were established using a correlational research design, which is difficult to explain explicitly, although hierarchical regression reveals the predictive contributions. In addition, the use of self-report assessment in data collection might introduce a response bias, although the constructs were validated using CFA. Finally, our CFA results on TLI, CFI and RMSEA for faculty caring suggested virtually no measurement error, which is highly uncommon for social science research. Therefore, strict caution should be applied while interpreting the regression results.

Our study has two major implications, namely, theoretical and practical implications. Theoretically, our study contributes to the extant literature on learning, motivation and perseverance via student engagement and faculty caring, especially in higher education where remediated students tend to express self-defeating attributes and experience school failures. In addition, our study extends to empirical works on LLL because our study is in line with the assertion that formal and informal, as well as non-formal educational activities, are inevitable for individuals' personal and professional growth in academic environment. Practically, our study implication for teacher is that they should support students to enhance their academic engagement and tendencies for LLL in higher education by adopting adequate teaching methods and conducive learning conditions that encourage positive relationships with students. For instance, in order to enhance student engagement in academic activities, there is need for paradigm shift from teacher-centred approach to a more flexible student-centred one that will foster students' positive relationships with their teachers. A shift to a more flexible student-centred mode of instruction will allow the students to be actively involved in participatory teaching process in which members of the faculty care and support their immediate learning needs. Furthermore, practical implication for educational stakeholders and policymakers is that they should support education interventions that is geared towards promoting positive student-faculty relationships which have been found to be relevant in improving academic engagement and the tendencies for LLL amongst higher education science students.

We suggest that further studies that jointly examine all the dimensions of LLL tendencies should be conducted with more representative samples of higher education science students from different schools. In addition, future researchers should adopt more elaborate mixed method approach that include students' interview and also conduct a longitudinal study using the variables under study. Such replication studies will offer more research evidence on how to support student engagement and promote their tendencies for LLL.

Declarations

Author contribution statement

Emmanuel Nkemakolam Okwuduba: Conceived and designed the experiments; Wrote the paper.

Rose Amnah Abd Rauf: Performed the experiment; Wrote the paper.

Hutkemri Zulnadi: Analyzed and interpreted the data; Wrote the paper.

Kingsley Chinaza Nwosu: Contributed reagents, materials, analysis tools or data.

Funding statement

This work was supported by Tertiary Education Trust Fund (TETF-Fund) doctoral sponsorship at the University of Malaya, Malaysia (TETF/ES/UNIV/ANAMBRA/TSAS/2018/VOL. 1).

Data availability statement

Data included in article/supp. material/referenced in article.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper. <https://doi.org/10.1016/j.heliyon.2022.e10546>.

Acknowledgements

The authors would like to appreciate the participants that took part in the study. Our unreserved gratitude goes to the editorial board and reviewers of this manuscript for their conscious efforts in improving the quality of this work.

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