

The Relationship between ASD Symptomology, Performance, Experienced Problems and Benefits in Problem Based Learning (PBL) Curricula

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ABSTRACT

The attention for supporting students with Autism Spectrum Disorders (ASDs) at university has recently grown. However, no research to date has looked into the fit between ASD and a specific form of education, Problem-Based Learning (PBL). The current study uses a newly developed questionnaire that focuses on the four elements of PBL: constructive, self-directed, collaborative, and contextual learning. The questionnaire showed to be highly reliable. Although higher ASD symptomology predicted reported experience of more problems and fewer benefits of PBL, these experiences were not accompanied by lower grades. This indicates that ASD students benefit from working in PBL.

Keywords

Autism Spectrum Disorder (ASD), university education, students, Problem-Based Learning (PBL), transition.

INTRODUCTION

Autism is a developmental disorder that affects 0.6 to 1 per cent of the Dutch population (14). While its cause is thought to be biological, diagnosis is based on the behavioural and cognitive level (12). On each of these levels people with ASDs differ from neurotypical (NT) people, a term which is used within the autistic community for people who are not on the autistic spectrum (8). On the cognitive level, people with ASD process information differently than NT people (12; 16). This is seen in executive functioning (being less flexible in thinking and behaving), weak central coherence (seeing details instead of the integrated whole), impaired Theory of Mind (TOM) (being less able to put yourself in someone else's shoes), and hyper-or hypo-reactivity. On the behavioural level social-emotional deficits; (non)verbal communication deficits; and stereotypical, restricted, and repetitive behavioural patterns are seen as characteristics of ASD (12; 16).

Despite the possible impact of ASD on educational experience and performance, the recent increase of ASD students in higher education was initially not accompanied by an equally strong increase in research on the possible problems ASD students experience in educational settings (2; 3; 6; 9; 10). Only in recent years research started looking into problems ASD students face.

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In relationship to less flexibility in thinking and behaving and to weaker central coherence, ASD students often report having difficulties with prioritising, organizing, time management, initiating and aborting working on assignments, shifting between different subjects or sources of information, and (long-range) planning (2; 3; 9). Also, problems in top-down processing are reported because ASD students prefer bottom-up processing (3). Other challenges ASD students experience are related to impaired TOM and social-emotional and communication deficits. They often report group work and social interaction with peers as being a primary problem (3; 6). Lastly, ASD students experience problems on the emotional level. Transition from secondary education to university brings about stress and anxiety in ASD students (9), and activities such as group work appear to increase anxiety, which has a negative effect on both well-being and performance (3). These problems together make that ASD students have a higher drop-out and lower performance compared to NT students (15).

ASD Students in Problem-Based Learning (PBL) Curricula

To date, no research has looked into the experiences and performance of ASD students in specific forms of education, despite the fact that findings from such a study could have major implications. Therefore the present article examines whether the features of a constructivist form of education, PBL, are suitable to the needs of ASD students. In recent years, PBL has been more and more implemented in Dutch higher education, with one university (Maastricht University) using the approach in all its programmes and one university (Erasmus University Rotterdam) using it in an increasing number of programmes, including large programs such as law and psychology. Also, the Universities of Technology are increasingly implementing PBL-elements in their curricula. It therefore seems relevant to know whether this increasingly used educational approach is suited also to the needs of ASD students.

In PBL, students meet in small groups of approximately 10 students twice a week for two to three hours. Learning starts with a pre-discussion, in which the group discusses an ill-structured problem that needs an explanation. They discuss what they already know about the subject matter and form learning issues, questions that are intended to guide the search for information that will happen in the phase of self-study during which the students individually study the problem for a few days. They then meet again

in the post-discussion meeting, in which they critically evaluate the studied information and discuss how this information could help them answer the learning issues. The PBL view closely matches the basic constructivist ideas: learning should be a constructive process, a self-directed process, a collaborative process, and a contextual process (1). Research on the outcomes of PBL shows enhanced intrinsic motivation and interest in the subject matter, higher satisfaction with contact with teachers and fellow students, better long-term retention of both knowledge and skills, and a higher graduation rate, faster graduation, shorter study stops and less dropout compared to traditional curricula (10; 11; 13).

Why would PBL be a good or bad fit for ASD students? Concerning the constructive learning element, the process of actively searching for information and reconstructing knowledge networks fits the ASD desire to learn and the ASD need for structure, because the end goal (the learning issue) is clear. A possible misfit could arise from the weaker central coherence and the focus on bottom-up processing (12). Problems in seeing the bigger picture might make constructing an answer to a learning issue a difficult enterprise. On the other hand, the structure PBL offers could also provide the ideal practice environment in forming this bigger picture, because the learning issues in PBL are specifically designed to help students in collecting information and constructing it into a whole.

Concerning self-directed learning, PBL might be a good fit for ASD because the guidance and structure offered in PBL is extensive compared to traditional curricula. Students meet at fixed days and times, which could be beneficial for ASD students as they have difficulty structuring their time themselves. Another aspect that might fit well are the proximal deadlines. Exam dates and essay deadlines cover a maximum of five weeks, and during that time even more proximal deadlines of a few days are set because students need to prepare for the tutorial groups. This is opposed to more distant and less-structured deadlines in traditional curricula. Lastly, there are no shifts between different courses in PBL as students do only one course at a time. This especially fits ASD students because they have difficulty in shifting (3; 6).

Collaborative learning means that students learn by explaining and discussing information in groups (1). This might be the biggest challenge ASD students experience in PBL. Their neural set-up (e.g. impaired TOM) is likely to make social learning and discussing information into a difficult, stimulus-overloading, and stress-inducing experience. On the other hand, the small size of the groups could be in favour of the neural set-up of ASD students: students easily get to know each other, which could provide an advantage when group work is required.

Lastly, PBL proposes that learning should be a contextual process and that by looking at problems from multiple perspectives, transfer increases (1). Difficulty for ASD students could arise because PBL achieves transfer by discussing information. However, the problems that are used in PBL are specifically designed to elicit discussion and to make room for seeing both sides of a dilemma.

Therefore PBL could provide the right practice environment for learning to transfer knowledge.

Because to date no research has been done on the fit between ASD and PBL characteristics, the described ideas about how ASD students would perform in PBL are speculative. They are based on linking research done on ASD students and PBL curricula separately, but no research has combined ASD and PBL. Therefore the present study aims to be an exploratory study on the fit between ASD and PBL. This aim expresses itself in twofold. First, the psychometric qualities of a new questionnaire that assessed problems and benefits ASD students could experience in PBL were assessed. Second, it was examined whether higher ASD-symptomology in a non-pathological sample was related to performance and experienced problems and benefits in PBL.

METHODS

Participants

Participants were $N = 61$ students of the Erasmus School of Law (ESL) and the Faculty of Social Sciences (FSS) of the Erasmus University Rotterdam. $N = 17$ participants were recruited via an online message board; $N = 52$ participants were recruited via the psychology course credit system. Eight participants were excluded because of missing grades (4), doing a year for the second time (1), doing a different course (1), or giving no permission to the use of their data (2). The final sample counted 61 NT students of the ESL ($N = 13$) and the FSS ($N = 48$), with a mean age of $M = 20.26$ ($SD = 2.36$). The sample was predominantly female ($N = 56$) and most students were in their first year ($N = 48$). None of the participants indicated to have a diagnosis in the autistic spectrum.

Measures

Because to date no measure existed to examine the benefits and problems of ASD students in a PBL curriculum, a new questionnaire was created, existing of 20 questions that examined problems in PBL and 20 questions that examined benefits of the PBL curriculum. Questions had to be answered on a 4-point Likert-scale with answering options *seldom or never, sometimes, often, and almost always*. The score-range of both the problem- and benefit-part of the questionnaire 20-80.

For measuring ASD symptomology the Dutch translation of the Autism-Spectrum Quotient (AQ) was administered. The AQ consists of 50 questions that have to be answered on a 4-point Likert-scale with answering options *definitely agree, slightly agree, slightly disagree, and definitely disagree*. The psychometric properties of AQ have proved to be highly satisfactory (5). The minimum score was 50 (the individual does not report having autistic traits) and the maximum score 200 (the individual reports having the full range of autistic traits).

Performance of students was measured by asking the students about their mean grade on a 1-10 scale.

Procedure

Participants filled out an online questionnaire. First, informed consent was obtained. Then, some demographic

information was asked. Then the AQ and the PBL-ASD-Fit Questionnaire were explained and presented. Lastly, the participant was asked about his or her mean grade and was asked if he or she had a diagnosis in the autistic spectrum. Then the participant was thanked for participation and was given the email address of the experimenter in case of further questions.

Statistical analyses

In order to validate the questionnaire, Cronbach's alpha was used to calculate the reliability of both scales. Also, an exploratory factor analysis (principal component analysis, PCA) was performed on both scales to examine dimensionality of the four hypothesized PBL elements.

To see whether ASD symptomology was related to performance and the experience of problems and benefits in PBL, simple and multiple regression analyses and one correlation analysis were performed.

RESULTS

The Psychometric Qualities of the ASD-PBL-Fit Questionnaire

Cronbach's alpha was $\alpha = .85$ for the problem-scale, and $\alpha = .92$ for the benefit-scale. Therefore both scales proved to be highly reliable. However, the PCA demonstrated that the four sub scales on both scales were hard to distinguish. On the problem-scale, only the hypothesized constructive learning component could be separated. On the benefit-scale, only a self-directed learning component could be separated. Also, the benefit-scale suffered from multicollinearity, which indicated that not all items were necessary for this scale to exist.

The Autism-Spectrum Quotient (AQ)

The mean AQ score of the participants was $M = 99.87$ ($SD = 16.31$). The range was 68-144. The distribution was approximately normal, $D(61) = .07$, $p = .200$. Alpha was $\alpha = .89$, which is in line with previous findings (5). There was no difference in score between males and females ($t(59) = 1.52$, $p = .133$) or humanities (ESL) and social sciences (FSS) students ($t(59) = 1.11$, $p = .270$).

The Performance Measure (Grade)

The mean self-reported grade of all participants was $M = 6.41$ ($SD = 1.06$), with a range of 3-8. This did not differ between males and females, $t(59) = 0.86$, $p = .390$ or between ESL and FSS students, $t(59) = 1.10$, $p = .274$.

Combining the Measures

Simple regression analyses showed that AQ-score predicted reported problems in PBL: students with higher reported ASD symptomology reported experiencing more problems, $F(1, 59) = 20.84$, $p < .001$, $R^2 = .26$. This relationship was strongest for the collaborative learning element and did not apply to the constructive learning element. A second simple regression analysis showed that AQ also predicted reported benefits of PBL: participants with higher reported ASD symptomology reported experiencing fewer benefits of characteristics of PBL, $F(1, 59) = -7.18$, $p = .010$, $R^2 = .11$. Especially variance in benefits concerning the contextual learning element

was well explained by AQ-score. Reported benefits from the self-directed learning element were not significantly related to AQ-score. A last simple linear regression analysis showed that AQ-score did not predict performance, $F(1, 59) = .39$, $p = .534$, $R^2 = .01$.

A correlation analysis showed that problem-score was significantly related to benefit-score: experiencing more problems in PBL was significantly correlated with experiencing fewer benefits of PBL, $r(61) = -.78$, $p < .001$.

A multiple linear regression analysis showed that the experienced problems and benefits together did not predict performance, $F(2, 58) = 2.48$, $p = .093$, $R^2 = .08$.

All found relationships are summarized in Figure 1.

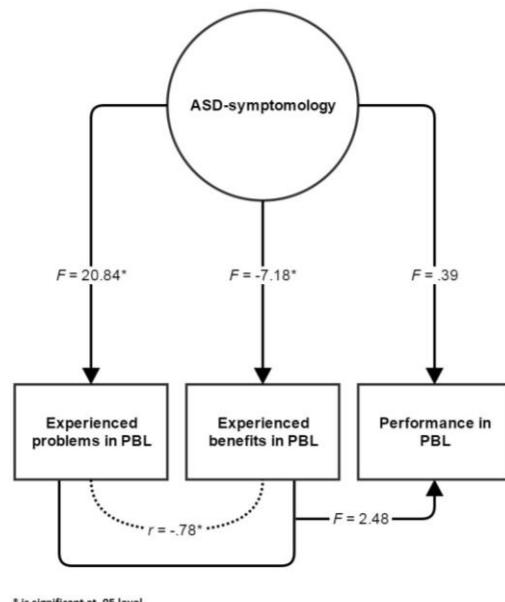


Figure 1: Relationships between ASD-symptomology, problems, benefits, and performance in PBL.

CONCLUSION AND DISCUSSION

People who scored higher on ASD-symptomology did report experiencing more problems and fewer benefits, but this did not show in their grades. In line with the hypotheses, higher ASD symptomology had the strongest impact on the collaborative learning problem scale and the contextual benefit scale, and did not have a significant impact on the constructive problem scale and the self-directed benefit scale.

What do these results tell us about the ASD-PBL-fit? Compared to previous research showing negative outcomes for ASD students in regular university curricula (15), the finding that students who score higher on ASD symptomology do not have lower grades in PBL is hopeful. It suggests that while ASD students underperform in traditional curricula, they perform well in PBL.

However, these equal grades were accompanied by higher reported problems and fewer reported benefits of PBL than NT students. One possible explanation for this found discrepancy is that PBL creates a safe and supportive practice environment with desirable difficulties in which

the student learns from and accommodates to the problems he or she experiences. One way to confirm this explanation would be if the negative relationship between grades and ASD-symptomology is stronger among first-year students than students from higher years. Regression analyses split according to study year showed support for this accommodation hypothesis. Among the total sample, .66 per cent of variance in grades could be explained by AQ-scores. Among only the 48 first-year students, this was higher (1.50 per cent), and among the 13 second-, third-, and fourth-year students this was lower (.03 per cent). It indicates that when students who score high on ASD symptomology get used to working in PBL, it might be a change for the better. This hypothesis should ideally be tested in a longitudinal design in which also post-education experiences on the work floor are examined to see whether the learning environment PBL creates forms a good preparation for working life.

If PBL forms a good fit to the ASD mind, than elements from PBL (e.g. the structure PBL offers) should be extracted and implemented in other educational settings. After all, also ASD minds deserve a chance to develop. As the famous autistic professor Temple Grandin states: 'The world is going to need all of the different kinds of minds to work together. We've got to work on developing all these different kinds of minds' (4).

ROLE OF THE STUDENT

The author was diagnosed with ASD at a young age and struggled on classic problem areas such as socialisation, structure, and routine. In being a student in PBL, she hypothesized which PBL characteristics did or did not fit with her needs as an autistic student. Curious if her experiences were true to more ASD students, she thought of a research design. After having found a supervisor, the research was honed and executed by the student. All analyses and writing was done by the student, with text suggestions by dr. Smeets.

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REFERENCES

1. Dolmans, D. H. J. M., De Grave, W., Wolfhagen, I. H. A. P., & Van der Vleuten, C. P. M. (2005). Problem-based learning: future challenges for educational practice and research. *Medical Education*, 39, 732-741.
2. Gelbar, N. W., Smith, I., & Reichow, B. (2014). Systematic review of articles describing experience and supports of individuals with autism enrolled in college and university programs. *Journal of Autism and Developmental Disorders*, 44, 2593-2601.
3. Gobbo, K., & Shmulsky, S. (2014). Faculty experience with college students with autism spectrum disorders: a qualitative study of challenges and solutions. *Focus on Autism and Other Developmental Disabilities*, 29, 13-22.
4. Grandin, T. (2010, February 24). The world needs all kinds of minds. Retrieved from http://www.ted.com/talks/temple_grandin_the_world_needs_all_kinds_of_minds/transcript
5. Hoekstra, R. A., Bartels, M., Cath, D. C., & Boomsma, D. I. (2008). Factor structure, reliability and criterion validity of the Autism-Spectrum Quotient (AQ): a study in Dutch population and patient groups. *Journal of Autism and Developmental Disorders*, 38, 1555-1566.
6. Knott, F., & Taylor, A. (2014). Life at university with Asperger syndrome: a comparison of student and staff perspectives. *International Journal of Inclusive Education*, 18, 411-426.
7. Mulder, A. M.. & Cashin, A. (2014). The need to support students with autism at university. *Mental Health Nursing*, 35, 664-671.
8. National Autistic Society (2014, October 1). How to talk about autism. Retrieved from <http://www.autism.org.uk/news-and-events/media-centre/how-to-talk-about-autism.aspx>
9. Pinder-Amaker, S. (2014). Identifying the unmet needs of college students on the autism spectrum. *Harvard Review of Psychiatry*, 22, 125-137.
10. Schmidt, H. G., Cohen-Schotanus, J., & Arends, L. R. (2009). Impact of problem-based, active learning on graduation rates for 10 generations of Dutch medical students. *Medical Education*, 43, 211-218.
11. Schmidt, H. G., Muijtjens, A. M. M., Van der Vleuten, C. P. M., & Norman, G. R. (2012). Differential student attrition and differential exposure mask effects of Problem-Based Learning in curriculum comparison studies. *Academic Medicine*, 87, 463-475.
12. Spek, A. A. (2014). *Mindfulness bij volwassenen met autisme*. Amsterdam, The Netherlands: Hogrefe Uitgevers.
13. Strobel, J., & Van Barneveld, A. (2009). When is PBL more effective? A meta-synthesis of meta-analyses comparing PBL to conventional classrooms. *Interdisciplinary Journal of Problem-Based Learning*, 3, 44-58.
14. Trimbos Institute (2010, March 9). Facts and numbers autism spectrum disorders. Retrieved from <http://www.trimbos.nl/onderwerpen/psychische gezondheid/autismespectrum-stoornissen/feiten-en-cijfers>
15. Wei, X., Christiano, E. R. A., Yu, J. W., Shattuck, P., & Newman, L. A. (2014). Postsecondary pathways and persistence for STEM versus non-STEM majors: among college students with an autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 44, 1159-1167.
16. Wicks-Nelson, R., & Israel, A. C. (2012). *Abnormal child and adolescent psychology*. Upper Saddle River, NJ : Pearson.